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This document is the first of a series of six volumes which together comprise a User's Manual for Premining Planning of Surface Coal Mining Operations in the Eastern United States. Recommended methods, techniques and alternatives for selecting and designing mining systems, based on a review and critical evaluation of the methods reported in the literature and applied in the field, and using the geological and hydrological settings prior to mining as basic inputs, have been structured into guidelines for developing, evaluating and selecting mining and reclamation plans, prior to commencement of mining, that will be least detrimental to the environment.

This first volume is an executive summary which provides first a review of the major considerations addressed in the research project; second, a discussion of the premining planning process; and third, an outline and summary of the contents and use of the other five volumes.

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Volume 1
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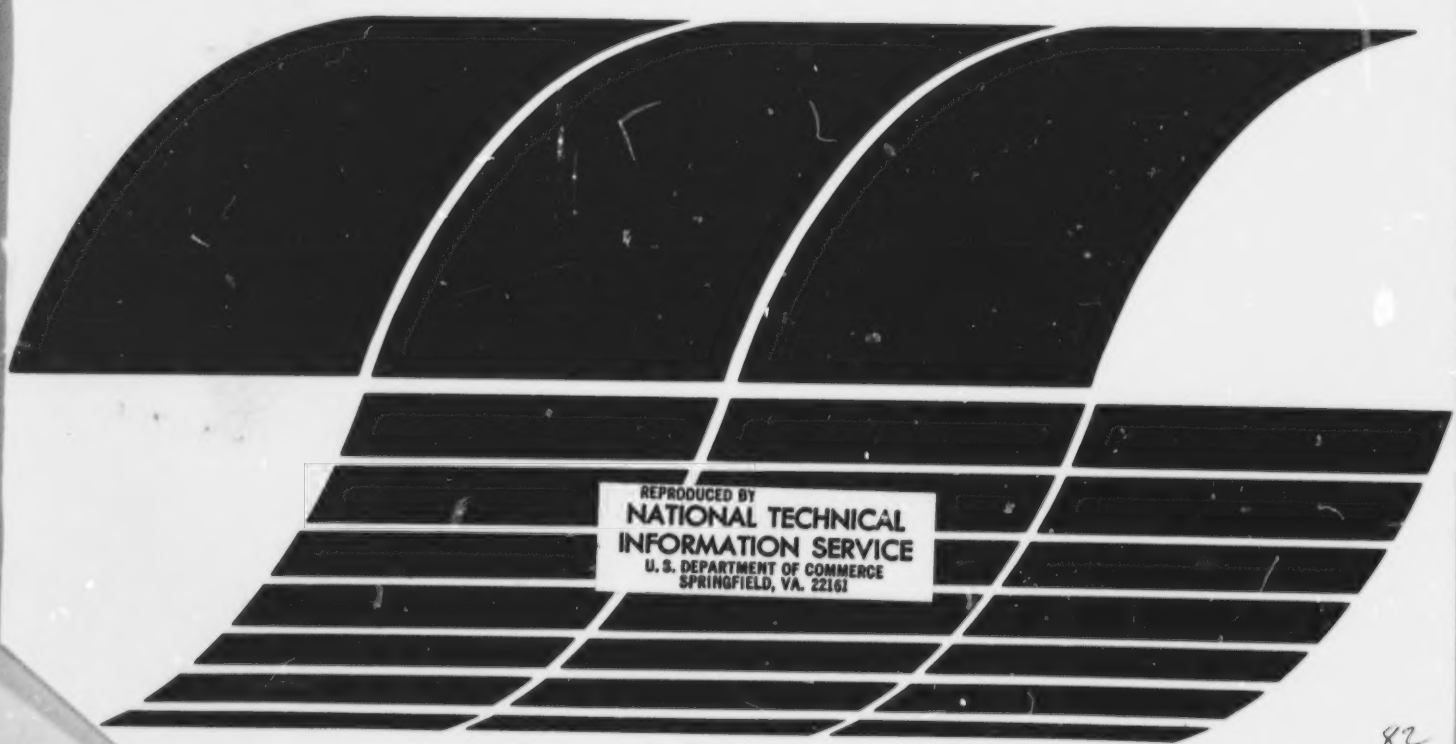

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USER'S MANUAL FOR PREMINING PLANNING OF EASTERN SURFACE COAL MINING
Volume 1: Executive Summary

by

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FOREWORD

When energy and material resources are extracted, processed, converted, and used, the related pollutional impacts on our environment and even on our health often require that new and increasingly more efficient pollution control methods be used. The Industrial Environmental Research Laboratory-Cincinnati (IERL-Ci) assists in developing and demonstrating new and improved methodologies that will meet these needs both efficiently and economically.

This document is the first in a series of six reports designed to provide the surface coal mining industry and its regulators with a comprehensive review of the best available methods for extracting coal while protecting the environment. This volume summarizes the structure, contents, and use of all the reports that together make up a user's manual for premining planning of surface coal mining operations in the eastern coal fields of the United States. For further information on this series of reports, contact the Resource Extraction and Handling Division.

David G. Stephan
Director
Industrial Environmental Research Laboratory
Cincinnati

ABSTRACT

The purpose of this research effort was to study the surface mining of coal in the Eastern United States and to establish guidelines for developing, evaluating, and selecting the least environmentally detrimental mining and reclamation practices. The study was to consider the geological and hydrological settings before mining as the basic inputs to premining planning, and guidelines were to be developed for assessing alternatives in the areas of surface mine engineering, water management, and land use planning.

The recommended methods, techniques, and alternatives for selecting and designing mining systems are based on a review and critical evaluation of the methods reported in the literature and applied in the field. They are presented in a series of six reports, which together make up a user's manual for premining planning of surface coal mining operations in the Eastern United States.

This report, which is the first in a series of six, provides an executive summary of the project. Four major areas are addressed. First, the major topics considered in the research project are briefly reviewed. Second, the premining planning process is presented and discussed. Third, the contents and use of the other five reports are outlined. And fourth, a series of appendices that provide supporting material for the first three areas are presented.

This report was submitted in partial fulfillment of Grant No. R803882 by the Department of Mineral Engineering of The Pennsylvania State University under the sponsorship of the U.S. Environmental Protection Agency. This report covers the period July 1, 1975, to May 30, 1978, and work was completed as of June 1, 1978.

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PROJECT STAFF

The materials contained in the manual were prepared by an interdepartmental and interdisciplinary group of the College of Earth and Mineral Sciences of The Pennsylvania State University. Overall management for the project was provided by the Department of Mineral Engineering. The project staff was comprised of the following personnel:

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SECTION 1

INTRODUCTION

SCOPE AND OBJECTIVES OF PROJECT

The U.S. Environmental Protection Agency (EPA) funded a research project at The Pennsylvania State University in July 1975 to study the surface mining of coal in the eastern United States (Figure 1) and to establish guidelines for developing, evaluating, and selecting the least environmentally detrimental mining and reclamation practices. The study was to consider the geological and hydrological settings before mining as the basic inputs to premining planning, and guidelines were to be developed for assessing alternatives in the areas of surface mine engineering, water management, and land use planning. The recommended methods, techniques, and alternatives for selecting and designing mining systems are based on a review and critical evaluation of the methods reported in literature and applied in the field.

This first volume of six provides an overview of the environmental concerns related to surface coal mining, an introduction to the premining planning process, and a brief description of the contents and use of the other reports, which are as follows:

Volume II - Surface Mining Engineering
Volume III - Geology of Eastern Coalfields
Volume IV - Mine Hydrology
Volume V - Mine Drainage Management and Monitoring
Volume VI - Mine Land Planning

Together these six volumes make up a user's manual for premining planning of surface coal mining operations in the eastern United States.

BACKGROUND

With the possible exception of agriculture, mining is the most basic of all industries. Even in agriculture, much of the fertilizer consists of minerals initially mined and processed, and finally enriched to the chemical form. In fact, virtually all aspects of human life as it exists today require the products of mining. Exploitation of mineral resources is a must if better standards of living are to be attained, since mining affects practically every phase of industrialization and provides the basics for sustained economic growth. The fundamental differences between mineral and other resources are that the former are highly localized, limited, and nonrenewable.

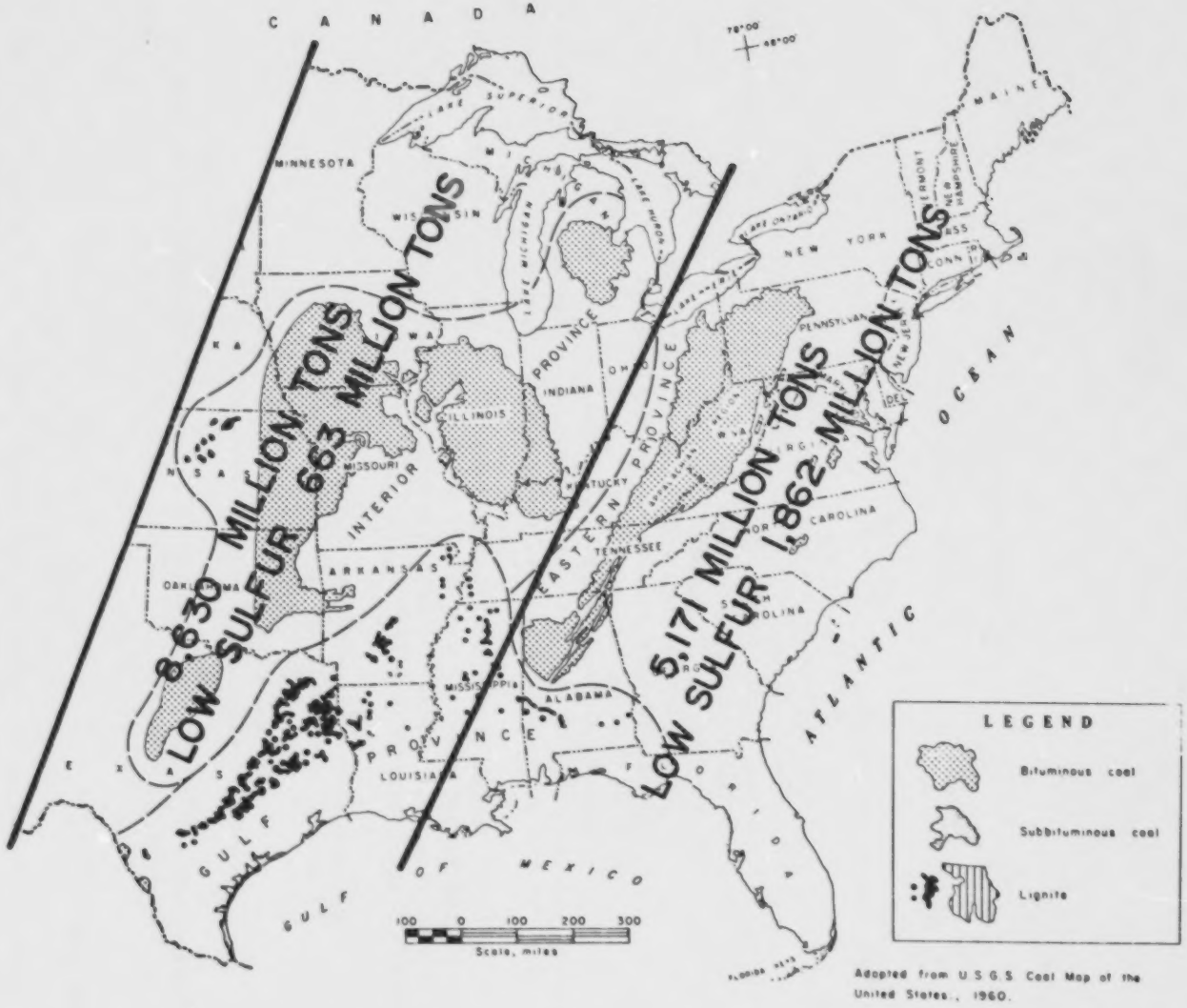

Figure 1. Coal regions of the Eastern United States.

In the most elementary form, mining is materials handling. It is a process of extracting in-situ materials (solids, liquids, or gases) from the crust of the earth. In this sense, both the extraction of mineral ores from the earth and the removal of gas and oil from underground chambers and the recovery of subterranean water can be considered mining. Both types of mining share many similar environmental considerations, but this project examines only the surface mining of coal in the eastern United States.

The Role of Surface Mining

The various mining methods can be classified as surface or underground. Surface mining accounts for over 90% of all mined products. And of all land affected by surface mining, more than 75% is the result of surface mining of coal, crushed stone, and gravel.

No major increase is anticipated for the share of coal in future energy demands. But the total national demand for energy is predicted to rise so rapidly that coal production itself is expected to be around a billion tons by 1985. If recent trends are any indication, surface-mined coal should continue to take a major share of the coal production, at least to the year 2000.

Decisions as to whether an orebody will be mined and what mining methods will be used depend on many technological, economic, ecological, and social factors. But the big question is: How can one mine these riches and still preserve the capability of the land for sustaining other uses during and after mining? Though this question is frequently viewed as a problem, it should also be recognized as an opportunity to restructure the land surface for a desirable end use.

Environmental Concerns

Mineral extraction affects the environment in three basic ways: It influences air, land, and water quality, which in turn affect plant and animal life (Table 1). The environmental effects of mining are, of course, interdependent. For example, air quality may influence water quality, and both combined can affect the capability of the land for sustaining habitation.

Legal Considerations

Surface coal mining has come under increasing legislative regulation, particularly with regard to the environmental effects. The use of surface-mined lands for other productive purposes was demonstrated and pursued voluntarily by some coal companies as early as 1920, when surface-mined coal accounted for less than 7% of total U.S. coal production. Nevertheless, before 1965, there were only seven states that had specific laws requiring land reclamation. West Virginia enacted the first such legislation in 1939. The period since 1965 has been one of rapid growth in laws and regulations regarding surface mining control at the Federal and State levels. Presently,

TABLE 1. MAJOR ENVIRONMENTAL EFFECTS OF VARIOUS SURFACE MINING UNIT OPERATIONS

Surface Mining Unit Operations	Water			Air			Land		
	Surface Water Contamination	Groundwater Contamination	Runoff and Infiltration Alteration	Exhaust Emissions	Dust Emissions	Other Emissions	Soil Erosion	Soil Stability	Soil Productivity
1. Exploration			X	X	X		X		
2. Area Dewatering and Diversion	X	X	X				X	X	X
3. Drilling			X	X	X				
4. Blasting			X		X	X		X	X
5. Overburden Removal	X	X	X	X	X	X		X	X
6. Haulage	X			X	X		X		
7. Soil Storage	X		X	X	X		X		X
8. Maintenance	X			X	X	X			
9. Reclamation	X	X	X	X	X		X	X	X

new or amended regulations are in force in 38 States. The most recent Federal legislation to affect surface mining is the Surface Mining Control and Reclamation Act of 1977 (Public Law 95-87).

There have always been other laws and regulations under which control was exercised over surface mining by such agencies as the Bureau of Land Management, the U.S. Mine Safety and Health Administration, State highway departments, and local zoning authorities. But, under P. L. 95-87, the Office of Surface Mining Reclamation and Enforcement was created in the Department of the Interior. Surface Mining Reclamation and Enforcement Provisions (rules and regulations) are contained in Chapter VII, Title-30, Mineral Resources of the Code of Federal Regulations (CFR). Several major aspects of the Environmental Protection Performance Standards can be found in Section 515 of P. L. 95-87 and Parts 715-718 of the Regulations (Chapter VII, Title 30).

Title 1 of the Act (Sec. 101) recognizes the many adverse effects of surface mining operations and the need to minimize them insofar as practicable. It further declares that responsibility for developing, issuing, and enforcing surface mining regulations should rest with the States. The purposes of the Act are identified as follows (Sec. 102):

a. To establish a nationwide program to combat the adverse effects of surface coal mining operations;
b. To assure that the rights of surface landowners and others with legal interests in the land are fully protected;
c. To assure that surface mining is not conducted where reclamation is not feasible;
d. To assure that surface mining is conducted so as to protect the environment;
e. To assure that surface-mined areas are reclaimed as contemporaneously as possible with the mining operations;
f. To strike a balance between the Nation's need for coal and protection of the environment;
g. To assist the States in implementation of programs to achieve these ends;
h. To promote the reclamation of areas degraded before enactment of this legislation; and
i. To assure public participation in reclamation plans and programs.

Land-Use Planning

Mine planning must include a careful determination and demonstration of how the mined land is to be used afterward. Such determinations will dictate the most effective plans for mining and reclamation.

Premining definitions of long-range use plans make it possible to minimize any disturbance of the land and also to limit reclamation activities to those required by the future-use plans. The integrated mining, reclamation, and land-use planning diagram in Figure 2 outlines a procedure for the evaluation of mining and reclamation plans and shows the various interactions

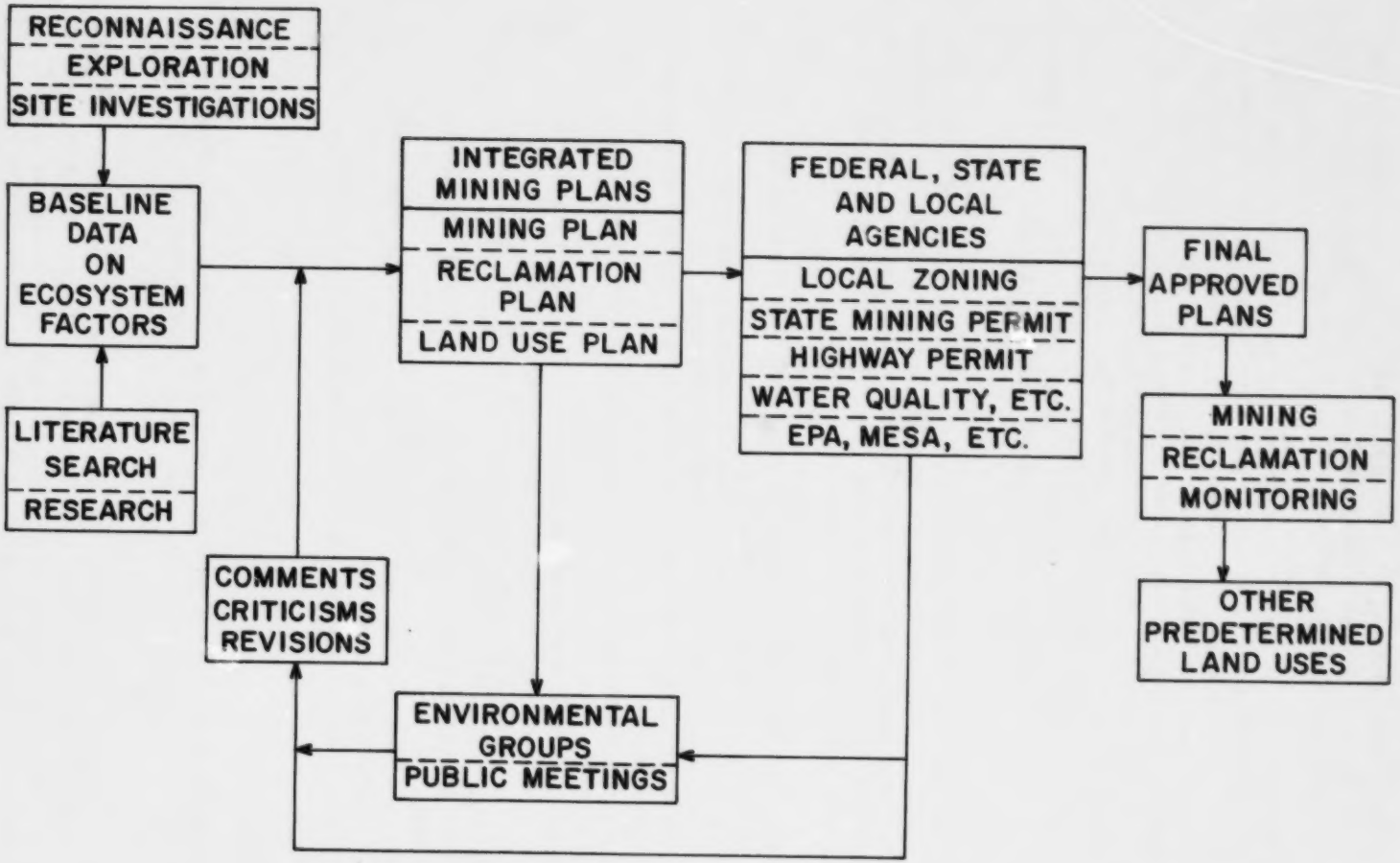

Figure 2. Integrated mining, reclamation, and land-use planning diagram.

that may take place before a mining plan can be put into practice. The process through which both the mining and reclamation have to pass include not only regulatory agencies, but special interest groups and the general public as well.

Integrated surface mining, reclamation, and land-use planning has several advantages. In mining areas characterized by the absence of any formal zoning or land-use activity, the mining operations are subject to the State or Federal laws regarding mining, and air, water, and land resources. In such a situation, the frequently determined post-mining land use is the premining land use, even though great potential may exist for creating an alternate land use.

Many potential land improvement projects never get further than the planning stage because of the relatively high cost of earth-moving and rehabilitation equipment and processes, and the high costs of building the transportation and communication networks. On the other hand, the ongoing mining operation must have these facilities, which can be retained and improved for later use by the community when the mining operation is completed. The infrastructure development so necessary for a mining operation (haulroads, other transportation networks, communications, power lines, office and recreational buildings, water facilities, etc.) can easily be designed for later use by surrounding communities or by new developments that can be planned around it. This concept is one of multiple and sequential land uses.

Land-use planning and control evoke rather difficult and emotional questions concerning public and private ownership, jobs, county development, taxes and earnings, local, State, and Federal economics, and authority over land-use decisions. Here the cooperation between mining companies and land-use planning authorities becomes very important. To make the reclamation planning process a success, each party must take into account the scope and limitations of the other. A selected list of these important factors is as follows:

a. Local/regional planning, coordination, and development are usually the responsibilities of local, regional, State, or Federal agencies and not the mining companies.
b. Government and other public land-use planning groups are concerned more with the surface utilization of land. Often their expertise may not extend to such matters as surface mine engineering and long-term impacts of mining.
c. Though some large mining companies can perform the required premining and postmining land-use analysis, most mining companies, particularly the small operations, lack expertise in this area.
d. Government planning for land use usually exists at a macro level dealing with large areas within local, State and Federal jurisdiction. On the other hand, company planning is usually at a micro level specific to a particular mining site and designed to operate at a profit, even though in compliance with the various legislative constraints.

e. Land-use regulation is predominantly a function of local government. The domain of these local governments is often not based on physiographic considerations, but on political subdivisions. On the other hand, there is a growing recognition that the effects of mining and mining itself may transcend several political subdivisions, and that therefore reclamation activities must be bounded by physiographic considerations and may encompass several local governments.

In short, the planning of surface mines, reclamation, and postmining uses of land have become very complex.

Premining Planning

From the premining planning point of view, two important characteristics of mineral resources are that they are highly localized and nonrenewable. Choices are limited for siting a mine, and once it is in operation, it has a finite life. Thus surface mining, like any type of mining, is a temporary and nonrenewable use of land. But the land itself is a permanent resource with many concurrent and sequential uses. Only through proper premining planning can such a resource be preserved and its possible multiple uses enjoyed. Otherwise, some of its uses may not be possible. In extreme cases, the land may be of no use and might even become a major source of environmental problems.

The ultimate objective of premining planning is to ensure a mining venture that has fully considered and provided for environmental capabilities and sensitivities on a national, regional, and site-specific basis. Environment, by definition, encompasses all aspects of life and living and includes both natural and cultural aspects. Environment is the net result of a complex, dynamic, and intimate interrelationship among the physical, biological, and social factors of its various systems (geologic, physiographic, hydrologic, demographic, etc.), components (rock, soils, climate), and processes (erosion, productivity, behavior).

Current legislative, administrative, and public attitudes toward surface mining and premining planning can be interpreted as an attempt to evaluate the multiple resources of an area (minerals, water, range, recreation, forestry, etc.) and to determine the location, size, and timing of their exploitation so that resource extraction (and/or utilization) that has preemptive or conflicting effects on other resources and uses is not allowed to occur except as planned.

The search is underway, not only for an understanding of the total environment and the needs for preserving it, but for the application of existing knowledge and technical skills to the total resource management for optimum benefits to present and future generations. Increasing concern and attention to premining planning is but one of the results of this change in the values and attitudes towards the extraction, utilization, and conservation of all the material resources.

SECTION 2

THE PREMINING PLANNING PROCESS

OVERVIEW

In the past, mining companies focused their efforts primarily on the basic concepts of development and production, and they handled technical problems as they arose. Traditional surface coal mine planning usually consisted of the following steps: (1) identifying and assembling a mineable coal reserve; (2) developing a market for the coal; (3) developing and analyzing conceptual mining plans for technical and economic feasibility; (4) obtaining a mining permit; (5) ordering the equipment; (6) building the infrastructure; and (7) developing the mine toward full production. During planning, some limited consideration was given to all the resources in the area and their profitable extraction and use within the mining operation. These various steps may overlap each other and can be conveniently grouped under the first two phases of the life cycle of a mining operation: exploration and development. Two other phases in the mine life cycle that must be recognized are the production and the reclamation.

What is new in the current approach to premining planning is a greater effort, mandated or otherwise, to consider all the non-mineral resources of the environment as well and to select the mining method that is most efficient and effective with regard to utilization of the total environment. In addition, premining planning must now encompass in detail every phase of the mine life cycle from beginning to end. Also, a greater industry/government interaction on mine planning aspects has become necessary. Environmental inquiry has become as integral a part of new facility planning as financial, engineering, and other traditional planning activities. In the planning of surface coal mines in particular, consideration must be given to the following concerns:

- -- pollution of water with sediments and chemicals;
- -- prevention of air pollution
- -- prevention of hazards to public health and safety;
- -- preservation and protection of the biologic community and ecological balance;
- -- minimization and control of erosion, slides, and wasting of land and soil;
- -- determination of long-term land uses;
- -- preservation and/or enhancement of the mine landscape and achievement of harmony with surrounding landscape;

-- preservation, protection, or minimization of damage to archaeological and historical sites;
-- anticipation and avoidance of future conflicts; and
-- optimization of specific resource extraction.

Consequently, the major premining planning steps can be summarized under the following headings:

1. Identification of regulatory requirements;
2. Data acquisition on the mine site and vicinity;
3. Preliminary feasibility study; and
4. Detailed mine feasibility study.

Data acquisition is a continuous activity, whereas the preliminary feasibility study is performed periodically with the best information available at the time. The preliminary feasibility study serves as a basis for deciding (1) the time and effort that should be expended on evaluation of the venture, and (2) the rate at which these resources should be expended. Recommendations of the preliminary study may be to abandon the project altogether, to collect data at a rapid rate to move from preliminary to detailed study, or to collect detailed data on some specific items to further the preliminary study.

A brief description of each of these premining planning steps is provided in the following sections.

IDENTIFICATION OF REGULATORY REQUIREMENTS

Surface mining regulatory requirements span many Federal, State, and local agencies. Tables 2 and 3 provide a summary of government involvement in surface mining operations at the Federal, State, regional, and local levels. Several permits and/or licenses are required during every phase of the mine life cycle. These permits, licenses, and requirements deal with land, water, air, right-of-way, health and safety of workmen, etc. Figure 3, which provides a summary of the government regulation of coal mining in Pennsylvania, illustrates the degree of regulation that can exist within a State.

A review of the reclamation requirements of the 20 states covered by this study was made in July 1977. A summary table is enclosed in Appendix A. These requirements may be under revision in view of the passage of the Surface Mining Control and Reclamation Act of 1977 (P. L. 95-87). The Act requires that all State programs for controlling surface coal mining be reviewed and approved or disapproved by the Office of Surface Mining Reclamation and Enforcement.

The types of information that are necessary to satisfactorily complete a mine permit application must be obtained by a detailed evaluation of the exploration data from the region and the mine site. Certain permits can take many months to process, and some permits may require extensive amounts of

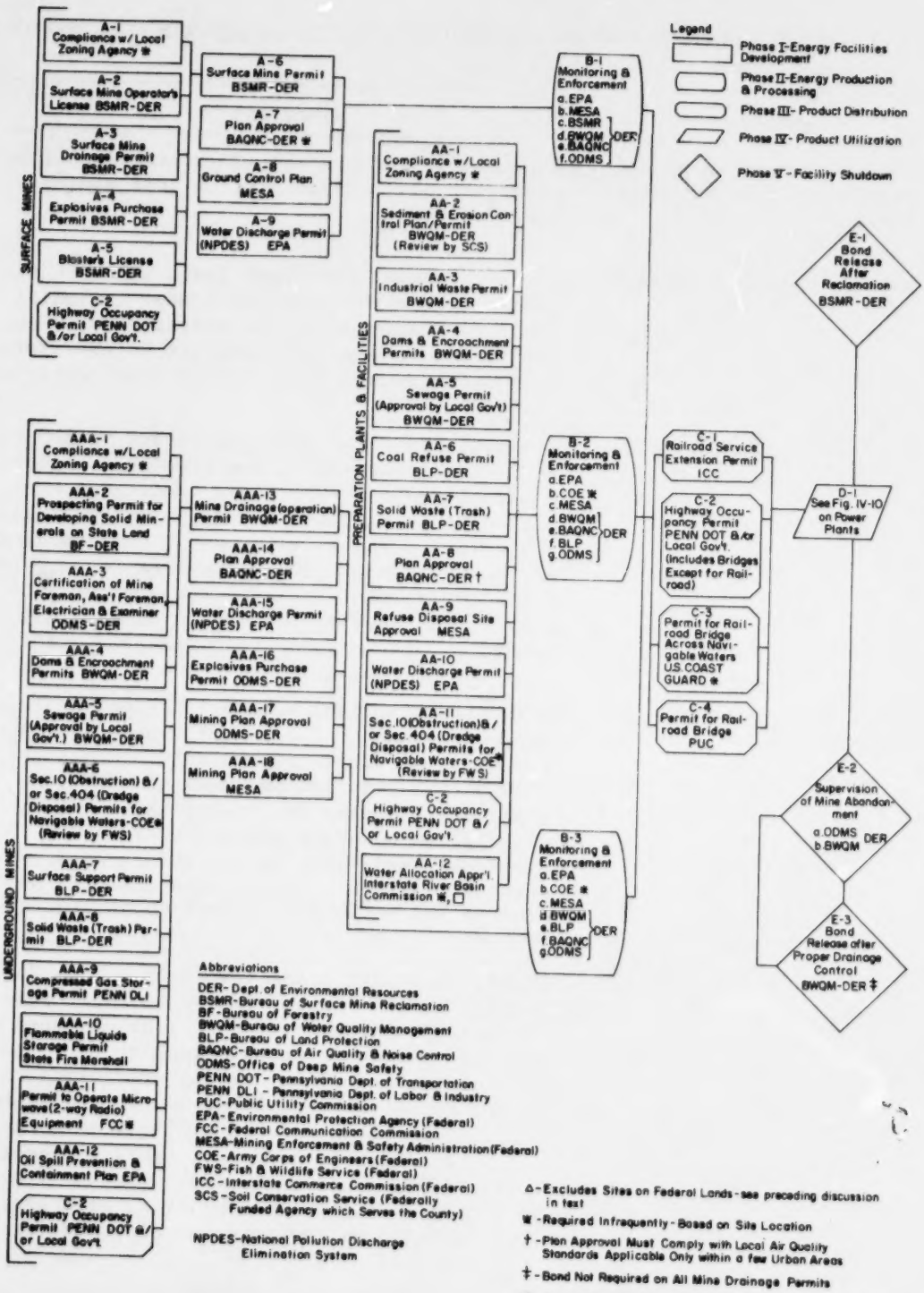
Legend
Phase I-Energy Facilities Development
Phase II-Energy Production & Processing
Phase III- Product Distribution
Phase IV- Product Utilization
Phase V - Facility Shutdown
SURFACE MINES
A-1 Compliance w/Local Zoning Agency *
A-2 Surface Mine Operator's License BSMR-DER
A-3 Surface Mine Drainage Permit BSMR-DER
A-4 Explosives Purchase Permit BSMR-DER
A-5 Blaster's License BSMR-DER
C-2 Highway Occupancy Permit PENN DOT &/or Local Gov't.
A-6 Surface Mine Permit BSMR-DER
A-7 Plan Approval BAQNC-DER *
A-8 Ground Control Plan MESA
A-9 Water Discharge Permit (NPDES) EPA
B-1 Monitoring & Enforcement a.EPA b.MESA c.BSMR d.BWQM e.BAQNC f.ODMS DER
PREPARATION PLANTS & FACILITIES
AA-1 Compliance w/Local Zoning Agency *
AA-2 Sediment & Erosion Control Plan/Permit BWQM-DER (Review by SCS)
AA-3 Industrial Waste Permit BWQM-DER
AA-4 Dams & Encroachment Permits BWQM-DER
AA-5 Sewage Permit (Approval by Local Gov't) BWQM-DER
AA-6 Coal Refuse Permit BLP-DER
AA-7 Solid Waste (Trash) Permit BLP-DER
AA-8 Plan Approval BAQNC-DER †
AA-9 Refuse Disposal Site Approval MESA
AA-10 Water Discharge Permit (NPDES) EPA
AA-11 Sec.10(Obstruction)&/or Sec. 404 (Dredge Disposal) Permits for Navigable Waters-COE * (Review by FWS)
C-2 Highway Occupancy Permit PENN DOT &/or Local Gov't.
AA-12 Water Allocation Appr'l Interstate River Basin Commission *, □
B-2 Monitoring & Enforcement a.EPA b.COE * c.MESA d.BWQM e.BAQNC f.BLP g.ODMS DER
B-3 Monitoring & Enforcement a.EPA b.COE * c.MESA d.BWQM e.BLP f.BAQNC g.ODMS DER
UNDERGROUND MINES
AAA-1 Compliance w/Local Zoning Agency *
AAA-2 Prospecting Permit for Developing Solid Minerals on State Land BF-DER
AAA-3 Certification of Mine Foreman, Ass't Foreman, Electrician & Examiner ODMS-DER
AAA-4 Dams & Encroachment Permits BWQM-DER
AAA-5 Sewage Permit (Approval by Local Gov't.) BWQM-DER
AAA-6 Sec.10 (Obstruction) &/or Sec.404 (Dredge Disposal) Permits for Navigable Waters-COE * (Review by FWS)
AAA-7 Surface Support Permit BLP-DER
AAA-8 Solid Waste (Trash) Permit BLP-DER
AAA-9 Compressed Gas Storage Permit PENN DLI
AAA-10 Flammable Liquids Storage Permit State Fire Marshall
AAA-11 Permit to Operate Microwave (2-way Radio) Equipment FCC *
AAA-12 Oil Spill Prevention & Containment Plan EPA
C-2 Highway Occupancy Permit PENN DOT &/or Local Gov't.
AAA-13 Mine Drainage(operation) Permit BWQM-DER
AAA-14 Plan Approval BAQNC-DER
AAA-15 Water Discharge Permit (NPDES) EPA
AAA-16 Explosives Purchase Permit ODMS-DER
AAA-17 Mining Plan Approval ODMS-DER
AAA-18 Mining Plan Approval MESA
C-1 Railroad Service Extension Permit ICC
C-2 Highway Occupancy Permit PENN DOT &/or Local Gov't. (Includes Bridges Except for Railroad)
C-3 Permit for Railroad Bridge Across Navigable Waters U.S. COAST GUARD *
C-4 Permit for Railroad Bridge PUC
D-1 See Fig. IV-10 on Power Plants
E-1 Bond Release After Reclamation BSMR-DER
E-2 Supervision of Mine Abandonment a.ODMS DER b.BWQM
E-3 Bond Release after Proper Drainage Control BWQM-DER ‡
Abbreviations
DER-Dept. of Environmental Resources
BSMR-Bureau of Surface Mine Reclamation
BF-Bureau of Forestry
BWQM-Bureau of Water Quality Management
BLP-Bureau of Land Protection
BAQNC-Bureau of Air Quality & Noise Control
ODMS-Office of Deep Mine Safety
PENN DOT-Pennsylvania Dept. of Transportation
PENN DLI-Pennsylvania Dept. of Labor & Industry
PUC-Public Utility Commission
EPA-Environmental Protection Agency (Federal)
FCC-Federal Communication Commission
MESA-Mining Enforcement & Safety Administration (Federal)
COE-Army Corps of Engineers (Federal)
FWS-Fish & Wildlife Service (Federal)
ICC-Interstate Commerce Commission (Federal)
SCS-Soil Conservation Service (Federally Funded Agency which Serves the County)
NPDES-National Pollution Discharge Elimination System
Δ-Excludes Sites on Federal Lands-see preceding discussion in text
* -Required Infrequently-Based on Site Location
† -Plan Approval Must Comply with Local Air Quality Standards Applicable Only within a few Urban Areas
‡ -Bond Not Required on All Mine Drainage Permits
□ -Formal Approvals Only Required for Plants within Jurisdiction of Susquehanna & Delaware River Basin Commissions

Figure 3. Coal industry regulation in Pennsylvania.

TABLE 2. INVOLVEMENT OF FEDERAL GOVERNMENT AGENCIES IN SURFACE COAL MINING OPERATIONS

Agency	Functions
1. Office of Surface Mining Regulation and Enforcement (OSMRE)*	Responsible for overall administration of programs for controlling surface coal mining operations.
2. Bureau of Land Management (BLM)	Conducts competitive coal lease sales on the public domain and acquired lands, including lands administered by the Forest Service and lands that make up the Wildlife Refuge System. Issues preference right leases when permittee qualifies.
3. U.S. Geological Survey (USGS)	Evaluates data and provides advice to BLM regarding areas proposed for leasing; approves mining plans and supervises operations conducted under BLM coal leases. Systematically collects and publishes geologic data necessary for mine planning, including base topographic maps, geological maps, water resources data, etc. Publishes information in methods and procedures for systematic collection and analysis of geologic data.
4. U.S. Environmental Protection Agency (EPA)	Primarily concerned with protection of air and water resources. Issues effluent guidelines for coal industry. Issues water discharge (NPDES) permits (and enforces stipulations contained therein) for States where a State program has not been approved. Provides technical assistance by conducting mining-related research programs, and issues user manuals for pollution control during surface mining.
5. U.S. Forest Service (USFS)	Regulates access roads that lead across Forest Service lands to areas leased for coal production, previews leasing actions proposed by BLM and recommends stipulations to be included in such leases. (Coal mining operations on leased Forest Service lands are regulated by the USGS. Forest Service public domain lands can be leased without Forest Service concurrence.) Conducts research programs on effects of surface coal mining operation, with particular emphasis on revegetation and wildlife.

* See Appendix D for a detailed description of the functions of OSMRE.

TABLE 2. INVOLVEMENT OF FEDERAL GOVERNMENT AGENCIES IN SURFACE COAL MINING OPERATIONS (Continued)

Agency	Functions
6. Bureau of Sports, Fisheries and Wildlife (BSF&W)	Provides advice and assistance regarding actions proposed by BLM to lease coal, and recommends stipulations to be included in such leases.
7. Mining Health and Safety Administration (MHSA)	Promulgates and enforces worker health and safety regulations in all coal mines. Requires submission and approval of a ground control plan before issuance of a surface mining permit. Sets training and educational requirements for certification of mining personnel. Conducts monitoring and enforcement programs on surface mining operations.
8. U.S. Bureau of Mines (USBM)	Provides technical assistance by systematically collecting and publishing statistical data for the coal mining industry. Conducts research programs and issues technical reports on all aspects of coal mining operation.
9. U.S. Corps of Engineers (CE)	May be involved in the permit review and monitoring and enforcement functions if the mine operations involve any aspects related to navigable waters (i.e. construction of bridges over navigable waters, etc.). Reviews EPA discharge permits to determine impact of permitted activity on navigation.
10. Occupational Safety and Health Administration (OSHA)	Establishes and enforces worker health and safety regulations in areas not regulated by other Federal agencies or by States under plans approved by OSHA.
11. U.S. Coast Guard (USCG)	Issues permits for railroad bridges across navigable waters where required.
12. Interstate Commerce Commission (ICC)	Issues railroad service extension permits where required.
13. Department of Energy (DOE)	Provides technical assistance through research programs.
14. Soil Conservation Service (SCS)	Provides technical assistance primarily through the functions of its local offices and plant research centers related to reclamation of surface mines.
15. Federal Communications Commission (FCC)	Issues permits to operate Microwave (2-way radio) Equipment

TABLE 3. INVOLVEMENT OF STATE, REGIONAL, AND LOCAL GOVERNMENT AGENCIES IN SURFACE COAL MINING OPERATIONS

Agency	Functions
State Agencies:	
1. Mining and/or reclamation agencies	Issue mining permits after consultation with other State and Federal agencies involved. Conduct monitoring and enforcement of surface mining operations. Approve release of bond upon satisfactory completion of reclamation operations. In some States, may issue a surface mine operator's license (See Appendices A and B).
2. Water resources agencies	The number of State agencies addressing water resources questions varies from state to state based on State government organization. Principal areas subjected to regulation include: (1) water utilization (withdrawals and consumption) (2) mine drainage (3) flood plain obstructions (4) water quality impacts (5) construction and operation of minor and major water impoundments Mining operations that involve any of these areas will require at least approval and possibly a separate permit from these agencies.
3. Air quality and noise control agencies	Although they are not present in all states, where they do exist they generally must provide approval of the mine permit before issuance.
4. Transportation agencies	Review proposed coal haulage routes, regulate size and weight of coal haulage units, and issue highway occupancy permits.
Regional agencies:	
1. River basin commissions	Set guidelines and priorities for water use and management within a river basin. Water allocation approval may be required.
2. Appalachian Regional Commission (ARC)	Provides technical assistance through research and demonstration programs. Compiles demographic data within the Appalachian region useful for mine land planning.

TABLE 3. INVOLVEMENT OF STATE, REGIONAL, AND LOCAL GOVERNMENT AGENCIES IN SURFACE COAL MINING OPERATIONS

Agency	Functions
3. Tennessee Valley Authority (TVA)	Provides technical assistance and guidelines to operators within their jurisdiction, primarily through research and demonstration projects.
Local agencies:	
1. Local planning (zoning) agency	Provides guidelines for postmining land uses primarily through its zoning power. May provide guidelines for various types of land use through its zoning ordinances, building, and subdivision regulations, etc. Approval of mining plan with particular emphasis on postmining uses may be required.
2. Soil Conservation Service (SCS)	Provides technical assistance locally to mine operators in areas of reclamation. May be required to review and approve any erosion and sediment control plan for the operation.

data. Very long lead times may have to be allowed for the collection of such data. Considerable care must be exercised in researching every possible source for locating legal requirements, because an obscure regulation that has been overlooked or considered inapplicable can have severe crippling effects on a project.

DATA ACQUISITION ON MINE SITE AND VICINITY

This premining planning activity goes hand in hand with a preliminary evaluation of mining and reclamation methods (preliminary feasibility study). The data needs for the preliminary and detailed evaluation of mine site and vicinity include information on both the natural and cultural components of the environment. The various analyses that need to be conducted in preliminary and detailed evaluations include:

1. Overburden and innerburden characterization--chemical and physical
2. Coal characterization--chemical and physical
3. Accessibility and market locations
4. Analysis of water resources
5. Topographic analysis
6. Soils analysis
7. Land use analysis
8. Analysis of terrestrial ecology
9. Analysis of aquatic ecology
10. Climatic analysis
11. Mine design and systems analysis
12. Manpower needs and availability

Some of the data required for these analyses (particularly regional data) may be obtained from the records of local, State, and Federal agencies. State and Federal geological surveys, Soil Conservation Service and State and Federal Forestry offices, Federal and State departments of commerce, census records, etc. are some prolific data sources within the public domain. In many instances, however, site-specific information can be obtained only through detailed exploration of the area at considerable expense.

The objective in this phase is to identify and quantify data for a specific site to evaluate the technical, economic, social, and environmental aspects both with and without the mine.

PRELIMINARY FEASIBILITY STUDY

The preliminary evaluation of mining feasibility may be conducted at a very early stage in the premining planning process, when there is still limited information on the various factors listed above. This phase determines the feasibility of mining by making some assumptions about missing data. The factors to be evaluated include the possible site constraints, site potential for postmining land uses, alternative integrated mining, reclamation and land-use plans, and the overall economics of the mining

venture. Examples of conditions that can pre-empt mining in a particular site include legal constraints such as protected/endangered species, topography requiring very complex mining and reclamation plans, environmental restrictions or requirements that make it difficult to put together a mineable package, market specifications for coal that cannot be readily met, etc. Consideration must be given to all the analyses mentioned before; the difference between this task and the last is one of data reliability and detail of analysis.

DETAILED MINE FEASIBILITY STUDY

The detailed mine feasibility study and report must be based on what is known beyond reasonable doubt, and they must meet several important requirements:

1. They must indicate with a high degree of reliability the potential of the mine to meet the economic objectives of the company.
2. They must demonstrate with a high degree of reliability that potential on-site and off-site environmental impacts have been considered and that the proposed activity is industrially and environmentally sound.
3. The report must make clear that a firm conceptual framework has been established for the mining operation and that this framework will not only be not radically changed but become the basis for detailed designs, equipment selection, and operation.
4. Items 1, 2, and 3 must be performed with adequate supporting evidence that the detailed feasibility document is acceptable to the regulatory agencies for the issuance of licenses and permits, and to the commerical lending institutions for considering the favorable financing of the application. The information in reports, memos, and other documents may come under public scrutiny during hearings and litigations. Thus credibility of the documents and supporting evidence cannot be over-emphasized.

Figure 4 conceptually depicts the relationship between the order of magnitude, the preliminary and definitive studies, and the percent of engineering completed. A permit application may be made when the project looks attractive, with only limited engineering completed. By the time the permit is granted, ample evidence is likely to be available showing that the variation from anticipated results will be very small.

As the study moves from preliminary evaluations to detailed planning, the number of personnel involved in the project also increases. Initial studies may be largely in-house projects with limited involvement of local consultants. At later stages, however, the project team may include many engineers, attorneys, environmental specialists, and technical and public relations experts. The complete feasibility study will encompass many different areas and may have several reports. Examples of the areas studied

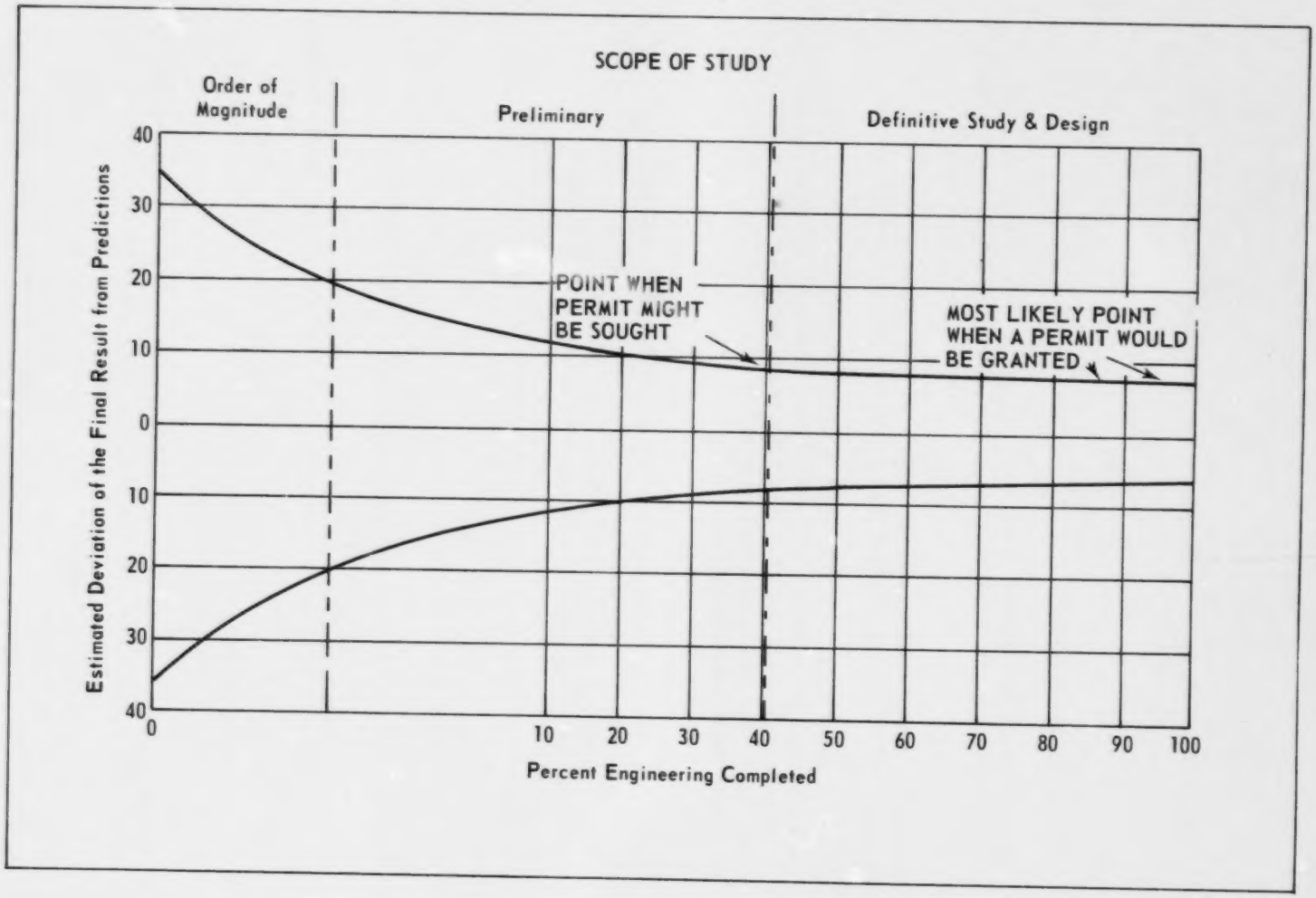

Figure 4. Funnel Effect: Impact of change in scope versus time.

and the types of reports that may be prepared are shown in Figure 5. The major activities must be properly time sequenced. A representative time sequence is shown in Figure 6.

As stated in the introduction, the scope of the present project is limited to premining planning of surface mine engineering and reclamation considering only the geological and hydrological aspects.

STUDY GROUP	STUDY AREA	STUDY REPORT
1. Legal Department 2. Real Estate Department 3. Consultants	I. LAND AND RESERVE ACQUISITION Ownership Patterns Land Option Acquisition Permit Requirements Title Search, Royalty, Fees etc. Other Legal Requirements	Legal Report
1. Geology & Mining Engineering Field Geologist Field Office Head Office 2. Consultants	II. EXPLORATION AND RESERVE EVALUATION Geological Survey Geological Mapping Preliminary Drilling Program Intermediate Drilling Program Geophysical and Geochemical Surveys Detailed Drilling Program Hydrologic Evaluation Soils Survey Ore/Coal Quality Estimation Reserve Estimation (Geological and Mineable)	Geology Report
1. Processing Department 2. Consultants	III. PRODUCT PREPARATION Coal Preparation Tests Pilot plant Tests Yield, Ash, Sulfur, Btu analyses Water Requirements Waste/Reject Percentages Plant Design Concepts Economic Analysis-Capital and Operating	Coal Processing Report

Feasibility Report

Figure 5. Premining planning study groups, areas, and reports.

STUDY GROUP	STUDY AREA	STUDY REPORT
1. Marketing Department 2. Consultants	IV. MARKET DEVELOPMENT Coal Quality Requirements Letter of Intent Market Prices, Escalation Factors	Market Report
1. Mining Engineering Department 2. Consultants	V. MINE DESIGN Preliminary Mine Design Pit Design-length, width, tonnage, and spoil area Spoiling Sequence Equipment Selection for Topsoil, and Overburden Drilling and Blasting Coal Loading Coal/Waste Hauling Ancillary Equipment Reclamation-Phasing of Active Mining with Reclamation Environmental Control Measures Economic Analysis - Capital and Operating Costs	Mining Report
1. Mining Department 2. Geohydrologist 3. Environmental Department 4. Consultants	VI. ENVIRONMENTAL IMPACT ASSESSMENT Environmental Impacts: On-Site and Off-Site Water Management Air/Noise Pollution Aquatic/Terrestial Ecology Land Use Analysis Toxic Material Burial Erosion Control Fugitive Dust Control Waste Disposal Climatic Analysis	Environmental Report

→ Feasibility Report

Figure 5. Premining planning study groups, areas, and reports (Continued).

STUDY GROUP	STUDY AREA	STUDY REPORT
1. Construction Department 2. Consultants	VII. SERVICES CONSTRUCTION Construction Site, Drawings and Plans Access Roads Electrical Lines Machine Shop and Auxiliary Facilities Relocation and Diversion of Facilities Railroad Sidings Economic Analysis-Capital and Operating Costs	Construction Report
1. Finance Department 2. Consultants	VIII. FINANCIAL ANALYSIS Taxes and Insurance Financial Requirements Financial Sources Preliminary Financial Committments Revenue and Profit Analysis	Financial Report
1. Personnel Department 2. Legal Department 3. Consultants	IX. ADMINISTRATIVE SERVICES Administrative Services/Structure/Strength Labor Structure and Strength Housing and Transport of Employees Social Requirements of Employees Public Relation Needs-Public Meetings, Awareness Campaign etc.	Personnel Report
1. Mining Engineering Department 2. Mine Operating Department 3. Construction Department 4. Contractors/Consultants	X. MINE DEVELOPMENT Mine Construction Schedule Waste/Reject Disposal Area Equipment Construction	

Construction Report, Financial Report, Personnel Report → Feasibility Report

Figure 5. Premining planning study groups, areas, and reports (Continued).

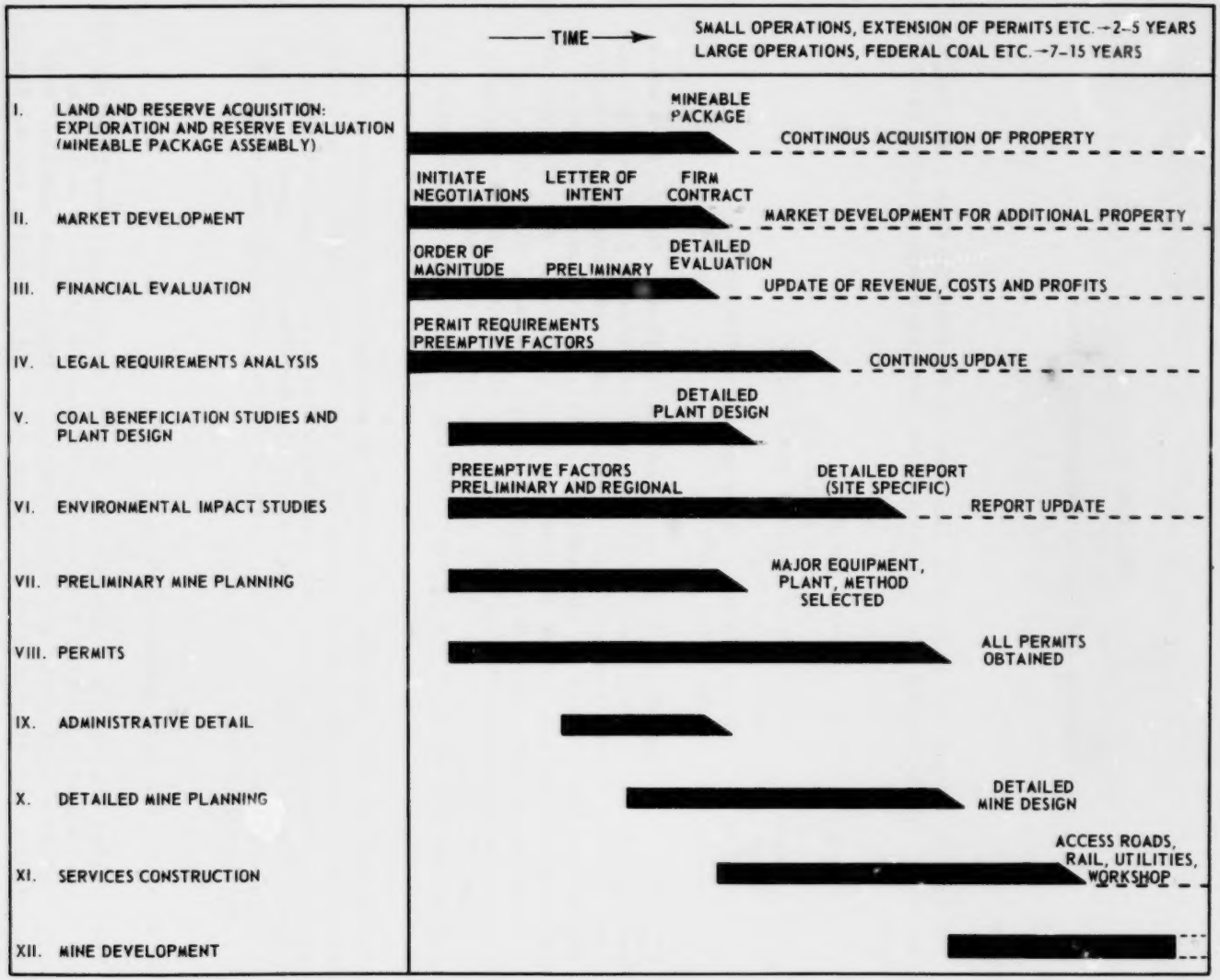

Figure 6. A time frame for premining planning study areas.

SECTION 3

SUMMARY AND USE OF BACKGROUND REPORTS

OVERVIEW

The User's Manual for Premining Planning of Eastern Surface Coal Mining is made up of the following six volumes, which are described briefly in this section:

Volume I - Executive Summary
Volume II - Surface Mine Engineering
Volume III - Geology of Eastern Coalfields
Volume IV - Mine Hydrology
Volume V - Mine Drainage Management and Monitoring
Volume VI - Mine Land Planning

The study was limited in scope to three major areas: (a) Surface mine engineering; (b) water management; and (c) land-use planning. Since geology and hydrology are basic inputs to mine planning and water management, separate reports on the geology of the eastern coalfields (Volume III) and on the hydrological considerations (Volume IV) were prepared. Specifically excluded from the project scope were the biological (animal, plant life, or recreation) and socio-economic areas. However, the mine land planning report (Volume VI) does touch on the climatic, judicial, economic, and demographic systems as they relate to premining site evaluation for postmining land use.

These reports are intended to define the rationale and procedures for premining site evaluation and to serve as an aid to mine operators and control personnel in developing, evaluating, and selecting mine reclamation practices that will be the least detrimental to the environment. Several other EPA manuals are also available (see Appendix C) to complement and supplement the reports prepared during this project.

VOLUME II - SURFACE MINE ENGINEERING

This volume presents a comprehensive summary of the analyses required to lay out a surface mine, taking into consideration the limitations imposed by geology, available equipment, and environmental control requirements. Methods, techniques, and alternatives are recommended for selecting and designing mining systems that include (1) soil handling and storage, (2) overburden

handling, segregation and disposal, and (3) minimization of the adverse environmental effects of drilling, blasting, off-highway truck transportation, coal loading, etc. The major topics covered in this report are:

1. Exploration
2. Surface mining equipment
3. Surface mining methods
4. Fragmentation practices
5. Surface mine haulroad design
6. Slope stability
7. Operational considerations
8. Reclamation
9. Surface mining costs

VOLUME III - GEOLOGY OF EASTERN COALFIELDS

The geology report is primarily intended as a summary of the regional coal geology and a background for many of the hydrologic, engineering, and land-use considerations covered in the other reports. Geology is of course a determining factor in the surface mining of coal, mine area restoration, and environmental impact of the mining process.

Major topics covered in this report include:

1. Occurrence of sulfur in coal
2. Paleoenvironments
3. Structural setting
4. Central Appalachian region
5. Southern Appalachian region
6. Eastern interior region
7. Michigan basin
8. Western interior province

VOLUME IV - MINE HYDROLOGY

This volume presents many of the basic hydrogeological and geochemical concepts regarding the occurrence and movement of groundwater within soil and bed rock strata of the mineable coal beds in the Eastern United States. Selected basic concepts that must be considered in all mine planning are reviewed: Definition of premining and postmining hydrological budgets, premining and postmining groundwater flow systems, data required for such analyses and methods of collection, basic approaches to these analyses, etc. Major emphasis is placed on the groundwater segment of the hydrologic cycle rather than the surface water segment.

The major topics covered in Volume IV include:

1. Hydrologic cycle
2. Surface water systems
3. Soil water system

4. Infiltration indices
5. Groundwater flow system
6. The nature of porosity and permeability of coal-bearing and associated strata
7. Factors controlling mine drainage discharge locations
8. Low relief areas
9. Mechanisms to cause water supply failures
10. Aquifer construction
11. Changes in water divides
12. Proximity to deep mines
13. Exploration and testing procedures
14. Pumping test procedures
15. Data analyses
16. Dewatering systems
17. Determining inflow rates to mines

VOLUME V - MINE DRAINAGE MANAGEMENT AND MONITORING

Volume V provides a technical background on which to establish pragmatic guidelines for making decisions about water quality management in surface mining. Four major areas of concentration are identified. The first area is that of mine drainage control and the nature of coal mine water. The second area involves drainage abatement techniques commonly used in surface mining. The third area includes a number of experimental techniques currently being considered as having some potential for controlling mine drainage. The fourth and final area involves the various aspects of monitoring programs.

Some of the major topics covered in this report include:

1. Geographical trends in surface mining of coal related to water quality management
2. Origin and quality of water encountered in surface mining
3. Governmental regulations
4. Control of water movement
    a. Surface flow control
    b. Control of soil water
    c. Strata dewatering
5. Actions based on nature of overburden
    a. Establishment of water pollution potential
    b. Approaches using overburden segregation
    c. Limestone treatment of strip mine spoil
    d. Minimizing oxidation conditions
6. Utilization of settling ponds
7. Treatment of water associated with surface mining
    a. Minimizing the introduction of coal fines and silt into waters during mining
    b. Water treatment in the open cut
    c. Treatment of water after removal from open cut
    d. Carbonate rocks added to acid water

8. Experimental techniques for treating surface mine waters
    a. Ion exchange
    b. Reverse osmosis
    c. Development of water storage in lieu of direct release
    d. Soil as a renovation medium
    e. Sewage sludge and effluents
9. Monitoring programs
    a. Monitoring wells
    b. Soil water
    c. Long-term changes in precipitation

VOLUME VI - MINE LAND PLANNING

This report concerns itself primarily with the postmining uses of the mined land. The emphasis is twofold: First, a review of the site factors that determine the suitability of the mined land for alternative uses is provided. And second, the site planning considerations associated with a number of major land use types (i.e., residential, institutional, commercial, industrial, agricultural, and silvicultural) are presented.

Some of the major topics covered in this report include:

1. The mine land planning process
2. Identification of regulatory constraints
3. Geographic site factors
4. Geomorphic site factors
5. Soil site factors
6. Climatic site factors
7. Site considerations for residential land use
8. Site considerations for institutional land use
9. Site considerations for commerical land use
10. Site considerations for industrial land use
11. Site considerations for agricultural land use
12. Site considerations for silvicultural land use

CONCLUSION

This six-volume report, together with a number of other complementary and supplementary reports referenced in Appendix C, provides a foundation for comprehensive premining planning of surface coal mining operations. Table 4 shows how the materials provided in each report relate to the various components and activities of the premining planning process.

A breakdown of typical data that are often required by regulatory agencies is provided in Appendix E. This list was developed by compiling the data required from companies applying for a mining permit in all 20 States covered by this report, as well as in a number of selected western States. These data are provided as illustrations only, and although they are very extensive and comprehensive, they may not entirely satisfy the

requirements within a given state. The operator should thus always check with the regulatory agencies of the State in question to assure full compliance with their requirements.

TABLE 4. MAJOR COMPONENTS OF PREMINING PLANNING COVERED IN THE USER'S MANUAL

Major Components and Activities	Volume I Executive Summary	Volume II Surface Mine Engineering	Volume III Coal Geology	Volume IV Mine Hydrology	Volume V Mine Drainage Management and Monitoring	Volume VI Mine Land Planning	Other
The premine planning process	1*	2		3	3	2	
Grouping of major activities	1	2					
Description of major activities	1	2		2	2		
Identification of regulatory requirements	1				2	2	
Permits and licenses required	1						
Laws and regulations	1					2	
Bonding requirements	1						
Effluent criteria	1				1		
Exploration and mapping							
Literature review		1		1			
Field Reconnaissance		1		2	2		
Government agency contact	1	1					
Drilling and mapping		1		1			
Feasibility report	1						
Site evaluation						1	
Analysis of land use patterns						1	
Geologic analysis			1	2	2		
Geotechnic analysis		1					
Coal characterization		1			1		
Climatic analysis				2	2	1	
Topographic analysis				2		1	
Soil analysis				2	2	2	3
Analysis of terrestrial ecology							3
Analysis of aquatic ecology							3
Analysis of water resources				1	1	2	
Analysis of equipment and mining method		1					
General classification of mining methods		1					
Mine design (pit width)		1					

* Code: 1 = detailed discussion; 2 = minor discussion; 3 = discussion in other EPA reports.

TABLE 4. MAJOR COMPONENTS OF PREMINING PLANNING COVERED IN THE USER'S MANUAL (Continued)

Major Components and Activities	Volume I Executive Summary	Volume II Surface Mine Engineering	Volume III Coal Geology	Volume IV Mine Hydrology	Volume V Mine Drainage Management and Monitoring	Volume VI Mine Land Planning	Other
Stripping equipment selection		1					
Topsoil		1					
Overburden		1					
Stripping equipment design		1					
Topsoil		1					
Overburden		1					
Other equipment		1					
Drilling and blasting		1					
Coal loading		1					
Coal hauling		1					
Ancillary equipment		1					
Bulldozers		1					
Scrapers		1					
Front-end loaders		1					
Road graders		1					
Maintenance trucks		1					
Waste-handling in pit		1			1		
Reclamation		1				2	
Phasing of active mining and reclamation		1		2			
Water management		2		1	1		
Identification of environmental control measures							
Surface water control				1	1	2	
Groundwater control				1		2	
Water quality control					1	2	
Control of fugitive dust		2			2		3
Controls during blasting		1					
Erosion control					1		
Control of toxic material		2			1		
Monitoring					1		
Mine land planning		2				1	
Evaluation of alternative land uses		2				1	
Selection of postmining uses		2				1	

APPENDIX A. STATE AND FEDERAL STRIP MINE REGULATION IN THE EASTERN AND MIDWESTERN COAL-PRODUCING STATES

Table A-1 compares State and Federal strip mine laws, rules, and regulations in the states reviewed for this manual. Below is a key to the designations used. If any other symbol is used it is explained in the text or in footnotes. The states are designated using the official U.S. Postal Service abbreviations.

KEY

L = the subject is mentioned explicitly in the state law

R = the subject is mentioned explicitly in the regulations (if mentioned in both the law and regulations, the law took precedence)

N = no mention is made regarding this subject in either the law or the regulations

A = although not specifically mentioned in either the law or the regulations, the law's tenor implies that some action regarding the requirement is advisable

TABLE A-1. STATE AND FEDERAL STRIP MINE REGULATION IN THE EASTERN AND MIDWESTERN COAL-PRODUCING STATES

	AL	AK	IL	IN	IA	GA	KS	KY	MD	MI	Fed
Regulatory Powers											
Enforce Rules Promulgated Under Law and Its Intent	L	L	L	L	L	L	L	L	L	N	BLM*
Promulgate Rules	L	L	L	L	L	L	L	L	L	N	BLM
Pass on Permit or License	L	L	L	L	L	L	L	L	L	N	USGS*
Inspections	L	L	L	L	L	L	L	L	L	N	R
1. Before Granting Permits	L	L	A	L	L	A	L	L	L	N	R
2. Operating Requirement	L	L	L	L	L	L	L	L	L	L	R
3. Reclamation	L	L	L	L	L	L	L	L	L	L	R
4. Revegetation	L	L	L	L	L	L	L	L	L	A	R
Stop Illegal Operations	L	L	L	L	L	L	L	L	L	N	BLM
Stop for Reason OTher Than Infraction of Law Rule or Regulations	N	N	N	N	N	N	N	N	N	N	R
Provisions for Appealing Regulatory Decisions	L	L	L	L	L	L	L	L	L	N	N
Licenses and Permits											
Strip Mine Operators License Different From Permit Required (duration in years indicated)	L	N	N	N	L(1)	L(1)	N	N	L(1)	N	N
Permit for Each Operation	L	L	L	L	N	L	L	L	L	N	R
Duration (years)	1	5	3	1	1	1	1	1	Mine Life	N	5
Permit and License Information Required on Application	L	L	L	L	L	L	L	L	L	N	R

*These are the federal agencies involved with control of surface mining of federal coal or coal on federal lands.

TABLE A-1. (Continued)

	MO	NB	NC	OH	OK	PA	SC	TN	VA	WV	Fed
Regulatory Powers											
Enforce Rules Promulgated Under Law and its Intent	L	N	L	L	L	L	L	L	L	L	BLM
Promulgate Rules	L	N	L	L	L	L	L	L	L	L	BLM
Pass on Permit or License	L	N	L	L	L	L	L	L	L	L	USGS
Inspections	L	N	L	L	L	L	L	L	L	L	USGS
1. Before Granting Permits	L	N	L	L	L	L	A	L	L	L	R
2. Operation Requirements	L	N	L	L	L	L	L	L	L	L	R
3. Reclamation	L	N	L	L	L	L	L	L	L	L	R
4. Revegetation	L	N	L	L	L	L	L	L	L	L	R
Stop Illegal Operations	L	N	L	L	A	L	L	L	L	L	BLM
Stop for Reason Other Than Infraction of Law Rule or Regulations	N	N	N	N	N	N	N	N	N	N	R
Provisions for Appealing Regulatory Decisions	L	N	L	L	N	L	L	L	L	L	N
Licenses and Permits											
Strip Mine Operators License Different From Permit Required (duration in years indicated)	N	N	N	L(1)	N	L(1)	N	N	N	N	N
Permit for Each Operation	L	N	L	L	L	L	L	L	L	L	R
Duration (years)	1	N	10	Mine Life	1	Mine Life	10	1	1	1	5
Permit and License Information Required on Application	L	N	L	L	L	L	L	L	L	L	R

TABLE A-1. (Continued)

	AL	AK	IL	IN	IA	GA	KS	KY	MD	MI	Fed
Location and Area of Proposed Permit	L	L	L	L	R	R	L	L	L	N	R
Area Fixed at Issurance	L	N	N	N	N	N	N	N	N	N	N
Permit Area Amendable With Approval of Revised Mine and Reclamation Plan	L	L	L	L	L	R	L	L	L	N	R
Access	L	A	L	L	L	R	L	L	L	N	R
Owner Names Land and Mineral	L	A	L	L	I	R	L	L	L	N	R
Owner Permission	L	L	L	L	L	A	L	L	L	N	R
Temporary and Permanent Addresses	L	A	L	L	L	L	L	L	L	N	R
History of Previous Permits	L	N	L	L	N	L	L	L	L	N	R
Public Notice Required	N	N	L	N	N	N	N	N	N	N	R
Application Fee (in dollars)	300+ 5/ acre	Per sched- ule	50+ 25/ acre	50+ 30/ acre	50	Per sched- ule	50+ 25/ acre	150+ 35/ acre	100	N	A
Bonds (dollars per acre)	1200	500	600	600	cost esti- mate	100- 500	300- 1000	400	450	N	cost esti- mate
Special Taxes and Fees (in dollars	N	N	N	N	N	N	N	L	30	N	N
Insurance (10^3 dollars)	1250	N	N	N	N	A	N	N	N	N	N
Pre-mining or Proposed Plan											
Map (USGS 7-1/2 minute) and Enlarged to Indicated Scale	R	500	L	L	A	A	400- 660	500	L	A	A
1. Color codes and symbol for map	A	R	A	N	A	A	L	R	R	A	A
2. Size	A	16x20	A	N	A	A	24x36	R	S	A	A

TABLE A-1. (Continued)

	MO	NB	NC	OH	OK	PA	SC	TN	VA	WV	Fed
Location and Area of Proposed Permit	L	N	A	L	L	L	L	L	L	L	R
Area Fixed at Issuance	N	N	--	N	N	N	N	N	L	N	N
Permit Area Amendable With Approval of Revised Mine and Reclamation Plan	L	N	L	L	L	L	L	L	L	L	R
Access	A	N	L	R	N	A	L	L	A	R	R
Owner Names Land and Mineral	L	N	A	L	L	L	L	L	L	L	R
Owner Permission	L	N	A	L	L	L	A	L	L	L	R
Temporary and Permanent Addresses	L	N	A	L	A	A	L	L	A	L	R
History of Previous Permits	L	N	L	L	L	L	L	L	L/R	L	R
Public Notice Required	N	N	N	For Bond Release	N	N	A	L	N	L	R
Application Fee (in dollars)	50+ 17.50/ acre	N	N	L	50	500		250+ 25/ acre	12/ acre	500	A
Bonds (dollars per acre)	300	N	L	L	350 650	Vari-able	Vari-able	1000 2000	or 300	6-10	cost esti-mate
Special Taxes and Fees (in dollars)	N	N	N	N	N	N	N	N	L	L	N
Insurance (10^3 dollars)	N	N	N	100-300	10	100	A	A	N	100	N
Pre-mining or Proposed Plan											
Map (USGS 7-1/2 minute) and enlarged to indicated scale	L	N	S	400	L	200	L	500	400	500	A
1. Color codes and symbol for map	A	N	A	R	A	R	A	R	R	R	A
2. Size	A	N	A	S	A	R	A	A	R	L	A

TABLE A-1. (Continued)

	AL	AK	IL	IN	IA	GA	KS	KY	MD	MI	Fed
Name and Location on Map											
1. Stream and Creek	L	A	L	L	A	A	L	L	L	N	R
2. Other Water Bodies	L	A	L	L	A	A	L	L	L	N	R
3. Roads	L	A	L	L	A	A	L	L	L	N	R
4. Building	L	A	L	L	A	A	L	L	L	N	R
5. Cemetaries	L	A	L	L	A	A	L	L	L	N	R
6. Oil and Gas Wells	L	A	L	L	A	A	L	L	L	N	R
7. Utilities	L	A	L	L	A	A	L	L	L	N	R
8. Railroad	L	A	L	L	A	A	A	L	L	N	R
9. Perimeter of Location	L	A	L	L	A	A	L	L	L	N	R
a. Area boundaries	L	A	L	A	A	A	L	L	L	N	R
With indicated from boundary	500	A	L	L	A	A	500	500	A	N	A
10. Coal Seams	A	A	L	A	R	A	L	L	R	N	R
Show on Map											
1. Seam Cropline	A	A	A	A	A	A	L	L	A	N	R
2. Area of Land Involved in Disturbed Area	L	L	L	A	L	L	L	L	L	L	R
3. Drainage Plan	R	A	L	L	A	A	L	L	L	N	R

TABLE A-1. (Continued)

Name and Location on Map	MO	NB	NC	OH	OK	PA	SC	TN	VA	WV	Fed
1. Stream and Creek	L	N	A	L	A	L	L	L	R	L	R
2. Other Water Bodies	L	N	A	L	A	L	L	L	R	L	R
3. Roads	L	N	A	L	A	L	L	L	R	L	R
4. Building	L	N	A	L	A	L	A	L	R	L	R
5. Cemetaries	L	N	A	L	A	L	A	L	R	L	R
6. Oil and Gas Wells	L	N	A	L	A	L	A	L	R	L	R
7. Utilities	L	N	A	L	A	L	A	L	R	L	R
8. Railroad	L	N	A	L	A	L	A	L	A	A	R
9. Perimeter of Location	L	N	A	L	A	L	A	L	L	L	R
a. Area boundaries	L	N	A	L	R	L	L	L	R	L	R
With indicated from boundary	660	N	A	500	N	1000	300	500	500	500	A
10. Coal Seams	L	N	A	A	A	A	A	R	R	L	R
Show on Map											
1. Seam Cropline	L	N	A	A	A	L	A	R	R	L	R
2. Area of Land Involved in Disturbed Area	L	N	R	L	A	L	L	L	R	L	R
3. Drainage Plan	L	N	A	L	A	L	L	R	L	L	R

TABLE A-1. (Continued)

	AL	AK	IL	IN	IA	GA	KS	KY	MD	MI	Fed
a. Flow direction arrows	R	A	L	A	A	A	L	L	R	N	R
b. Constructed drainways	R	A	L	A	A	A	L	L	L	N	R
c. Natural waterways	R	A	L	A	A	A	L	L	L	N	R
d. Receiving water bodies	R	A	L	L	A	A	L	L	L	N	R
1) on permit area	R	A	L	A	A	A	L	L	L	N	A
2) and within the specified radius of the boundaries	R	A	L	A	A	A	L	500	L	N	A
4. Date of the Map Preparation	L	L	R	L	A	A	L	L	L	N	R
5. North Arrow	L	A	R	A	A	A	L	R	R	N	R
6. Quadrangle Name	A	A	R	A	A	A	L	L	L	N	R
7. Deep Mine Location	A	A	R	A	A	A	L	L	L	N	R
a. under the permit area	A	A	R	A	A	A	A	L	L	N	A
b. within the specified radius (feet)	A	N	R	N	A	A	L	L	L	N	200
8. Identify Acid Producing Materials	L	A	R	A	A	A	L	R	L	N	A
9. Drill Hole Locations & Logs	A	A	L	A	A	A	A	R	L	N	R
10. Statement of Certification	L	A	L	L	A	A	L	L	L	N	N
A registered engineer must certify a map for large scale prospecting of coal (prototype variety) permit.	L	A	A	L	A	A	L	L	L	N	N

TABLE A-1. (Continued)

	MO	NB	NC	OH	OK	PA	SC	TN	VA	WV	Fed
a. Flow direction arrows	L	N	A	L	A	L	A	A	R	L	R
b. Constructed drainways	L	N	A	L	A	L	A	A	R	L	R
c. Natural waterways	L	N	A	L	A	L	A	R	R	L	R
d. Receiving water bodies	L	N	A	L	A	L	A	R	R	L	R
1) on permit area	A	N	A	L	A	L	A	A	R	L	A
2) and within the specified radius of the boundaries	A	N	A	L	A	L	A	A	500	500	A
4. Date of the Map Preparation	L	N	A	L	A	L	L	R	R	L	R
5. North Arrow	L	N	A	L	A	L	L	A	R	R	R
6. Quadrangle Name	L	N	A	L	A	L	A	R	R	L	R
7. Deep Mine Location	L	N	A	L	A	L	A	L	R	L	R
a. under the permit area	A	N	A	L	A	L	A	A	A	L	A
b. within the specified radius (feet)	A	N	A	500	N	L	A	500	500	500	A
8. Identify Acid Producing Materials	A	N	A	A	A	R	A	R	A	L	A
9. Drill Hole Locations & Logs	A	N	A	L	A	L	A	A	A	A	R
10. Statement of Certification	L	N	A	L	A	L	A	R	R	L	N
A registered engineer must certify a map for large scale prospecting of coal (prototype variety) permit.	L	N	A	L	A	L	A	L	R	L	N

TABLE A-1. (Continued)

Reclamation Standards	AL	AK	IL	IN	IA	GA	KS	KY	MD	MI	Fed
Reclamation & Planting Returned to Equal or Better Use	A	L	L	L	A	L	L	L	L	N	R
Backfilling & Grading											
1. Minimize Hazards	A	A	A	L	A	L	L	L	L	L	R
2. To Approximate Original Contour (maximum slope shown)	L	L	L	A	L	R	A	L	L	A	R
3. Eliminate Highwall or Reduce It	L	A	L	L	A	A	A	L	L	N	R
a. (Circumstances mitigate)	A	A	L	L	A	A	A	R	R	N	N
Cover Coal, Acid Producing & Toxic Material by Indicated Depth (ft)	A	3	4	2	2	A	2	4	R	N	R
Bury or Remove Toxic, Acid, Flammable Material and Refuse	L	L	L	L	L	A	L	L	R	L	R
No Refuse Allowed Beyond Permit Boundary	L	A	L	A	A	A	L	L	L	N	A
Terrace Bench Slope I - Away From Highwall II - Toward From Highwall	N	N	N	N	N	A	N	L-1	R	N	N
Maximum Slope of Terrace is Indicated in Percent	N	33	Per schedule	Per schedule	N	N	N	10	R	N	N
Time Limit to Begin Reclamation											
1. Differentiates Auger Area & Contour Mining	N	L	N	L	N	N	L	L	R	N	N
2. Days After Coal Removal	N	365	N	1	A	N	180	Per plan	Per plan	N	N
3. Distance Behind Present Work Area in Feet	N	N	N	ridges	A	N	R		N	N	N
Time Limit for Completion Reclamation After the Permit Has Expired (years)	1/2	2	2	1	A	N	1	1	A	N	N

TABLE A-1. (Continued)

Reclamation Standards	MO	NB	NC	OH	OK	PA	SC	TN	VA	WV	Fed
Reclamation & Planting Returned to Equal or Better Use	L	N	use only	L	use only	L	use only	use only	L	L	A
Backfilling & Grading											
1. Minimize Hazards	L	N	L	L	L	L	L	L	L	L	R
2. To Approximate Original Contour (maximum slope shown)	A	N	4:1	L	A	L	3:1	L	R	2:1	R
3. Eliminate Highwall or Reduce It	L	N	A	L	A	L	A	L	L	L	R
a. (Circumstances mitigate)	N	N	A	L	A	A	A	L	L	L	A
Cover Coal, Acid Producing & Toxic Material by Indicated Depth (ft)	4	N	A	L	3	3	A	4	4	4	R
Bury or Remove Toxic, Acid, Flammable Material and Refuse	L	N	A	L	A	L	A	L	R	L	R
No Refuse Allowed Beyond Permit Boundary	A	N	A	L	A	L	A	A	R	L	A
Terrace Bench Slope I - Away From Highwall II - Toward From Highwall	N	N	A	R	N	R-I	N	R-II	R-II	R-II	A
Maximum Slope of Terrace is Indicated in Percent	L	N	A	N	L	35	N	N	N	10	N
Time Limit to Begin Reclamation											
1. Differentiates Auger Area & Contour Mining	N	N	N	L	N	N	N	L R	R	R	N
2. Days After Coal Removal	180	N	A	90	365	N	per plan	180	30	90	N
3. Distance Behind Present Work Area in Feet	N	N	A	N	N	1500	N	1500	350	3000	N
Time Limit for Completion Reclamation After the Permit Has Expired (years)	1	N	2	1	1	5	2	1	N	N	N

TABLE A-1. (Continued)

Water Control	AL	AK	IL	IN	IA	GA	KS	KY	MD	MI	Fed
No Overburden Allowed in a Natural Drainage Ways	R	A	A	A	A	A	A	R	A	N	A
No Mining Within (indicated) Feet of Natural Drainage Ways	100	A	A	A	A	A	A	100	A	N	A
Haulage Ways Crossing Natural Drainage Cannot Restrict Flow of (indicated) Years Storms	A	A	A	A	A	A	A	25	A	N	R
Haulage Ways Crossing Natural Drainage Cannot Cause Siltation of That Drainway	A	A	A	L	A	A	A	L	L	N	R
A Separate Effluent Emission Permit Required	L	L	L	L	L	N	N	N	L	L	R
Drainage Ditches Must Control Velocity of Water to Prevent Erosion on Long Slopes	R	A	L	L	A	A	L	R	R	N	N
Drainage Ditches Must Intercept Water Above High-wall and Transport to Natural Drainway Effectively	R	A	L	A	A	A	A	R	R	N	R
Drainage Ditches in Pit Must be in Solid Bench and Break at Midpoint to Either Side of Pit	R	A	A	A	A	A	A	R	A	N	A
Drainage Ditches Below Spoil to Intercept Drainage From Same With (indicated) Feet	A	A	R	A	R	A	A	R	A	N	A
Drainage Ditches Must be Maintained (i.e., Free of Silt, etc.)	R	A	A	L	A	A	A	R	R	N	A
Drainage Ditches Shall Not Discharge Over Spoil (but through adequate channel or culvert provided in spoil)	R	A	A	A	A	A	A	R	A	N	A
Drainage Ditches Required on Sides of Haulage Road Cuts (both side through-cut, inside cut-fill)	R	A	A	A	A	A	A	R	A	N	A
Drainage Ditches Intercepted Water at Switch Backs	A	A	A	A	A	A	A	R	A	N	A

TABLE A-1. (Continued)

Water Control	MO	NB	NC	OH	OK	PA	SC	TN	VA	WV	Fed
No Overburden Allowed in a Natural Drainage Ways	A	N	A	A	A	A	A	R	S	R	A
No Mining Within (indicated) Feet of Natural Drainage Ways	A	N	A	A	A	L	A	25	A	50	A
Haulage Ways Crossing Natural Drainage Cannot Restrict Flow of (indicated) Years Storms	A	N	A	A	A	L	S	R	A	R	R
Haulage Ways Crossing Natural Drainage Cannot Cause Siltation of That Drainway	A	N	A	A	A	N	A	R	R	L	R
A Separate Effluent Emission Permit Required	L	N	N	L	L	L	N	L	L	N	R
Drainage Ditches Must Control Velocity of Water to Prevent Erosion on Long Slopes	A	N	R	A	A	L	A	L	A	R	N
Drainage Ditches Must Intercept Water Above High-wall and Transport to Natural Drainway Effectively	A	N	R	A	A	L	A	A	R	R	R
Drainage Ditches in Pit Must be in Solid Bench and Break at Midpoint to Either Side of Pit	A	N	A	A	A	R	A	R	S	R	A
Drainage Ditches Below Spoil to Intercept Drainage From Same Within (indicated) feet	A	N	A	A	A	A	A	S	R	25	A
Drainage Ditches Must Be Maintained (i.e., Free of Silt, etc.)	A	N	R	A	A	L	L	L	R	R	A
Drainage Ditches Shall Not Discharge Over Spoil (but through adequate channel or culvert provided in spoil)	A	N	R	A	A	L	A	R	R	R	A
Drainage Ditches Required on Sides of Haulage Road Cuts (both side through-cut, inside cut-fill)	A-	N	A	A	A	A	A	R	R	R	A
Drainage Ditches Intercepted Water at Switch Backs	A	N	A	A	A	A	A	R	A	R	A

TABLE A-1. (Continued)

	AL	AK	IL	IN	IA	GA	KS	KY	MD	MI	Fed
Drainage Ditches and Culvert Space for Haulroads By Formula and Cross-Sectional Area and Placement	A	A	N	A	N	A	A	R	A	N	R
Drainage Ditches and Other Temporary Drainage Structure Must Remain in Place Until Reclamation is Complete	A	A	A	A	A	A	A	R	A	N	
Impoundments											
Impoundment of Water is to be of Adequate Construction	N	A	L	A	R	A	R	R	R	N	R
Impoundment of Water Shall Have an Adequate Capacity	R	A	A	A	A	A	A	R	A	N	R
Impoundment May, if Approved, Modify Backfilling Requirements	R	L	L	L	L	A	L	L	R	N	R
Information for Impoundment Approval											
Location of the Impoundment Area and Plot Plan of Impoundment Area	R	A	A	L	A	A	L	R	R	N	R
Dimensions and Capacity Information (averages maximum and minimums)	R	A	A	L	A	A	L	R	R	N	A
Water Source of the Impoundment	R	A	R	L	A	A	L	R	R	N	A
Quality of Water Entering the Impoundment	R	A	L	L	A	A	L	R	R	N	A
Quality of Water Leaving the Impoundment and How It Leaves the Impoundment	R	A	L	L	A	A	L	R	R	N	A
Coal Seams Affecting the Impoundment	R	A	A	A	A	A	A	R	R	N	A
Characteristics of Soil and Rock Beneath the Impoundment Area	A	A	A	A	A	A	A	R	A	N	R

TABLE A-1. (Continued)

	MO	NB	NC	OH	OK	PA	SC	TN	VA	WV	Fed
Drainage Ditches and Culvert Space for Haulroads by Formula and Cross-Sectional Area and Placement	A	N	A	A	A	R	A	R	R	R	R
Drainage Ditches and Other Temporary Drainage Structure Must Remain in Place Until Reclamation is Complete	A	N	A	A	A	R	A	R	A	R	
Impoundments											
Impoundment of Water is to be of Adequate Construction	A	N	A	A	A	L	A	A	A	R	R
Impoundment of Water Shall Have an Adequate Capacity	A	N	A	A	A	R	A	R	R	R	R
Impound May, if Approved, Modify Backfilling Requirements	L	N	A	R	L	R	A	R	R	R	R
Information for Impoundment Approval											
Location of the Impoundment Area and Plot Plan of Impoundment Area	A	N	A	L	A	R	A	R	A	R	R
Dimensions and Capacity Information (averages maximum and minimums)	A	N	A	L	A	R	A	A	A	R	A
Water Source of the Impoundment	A	N	A	R	A	R	A	A	A	R	A
Quality of Water Entering the Impoundment	A	N	A	R	A	R	A	A	A	R	R
Quality of Water Leaving the Impoundment and How it Leaves the Impoundment	A	N	A	R	A	R	A	A	A	R	A
Coal Seams Affecting the Impoundment	A	N	A	R	A	R	A	A	A	R	A
Characteristics of Soil and Rock Beneath the Impoundment Area	A	N	A	R	A	R	A	A	A	R	R

TABLE A-1. (Continued)

	AL	AK	IL	IN	IA	GA	KS	KY	MD	MI	Fed
Safety Aspect of Impoundment	R	L	A	A	A	A	L	A	A	N	R
Landowner Consent for Impoundment	R	A	R	A	A	A	A	A	A	N	A
Haulage Roads											
Grading											
a. Maximum sustained grade in percent (shown)	R	A	30%	10%	A	A	25%	R	A	N	A
b. The maximum pitch of the road defined in percent per feet (indicate)	A	A	R	A	A	A	A	R	A	N	A
c. Road crown or inslope of road surface (in inches/foot)	A	A	A	A	N	A	A	1:24	A	N	A
d. Switch back grade shall be less than the approach grade and always less than indicated 10%	A	A	A	A	A	A	A	R	A	N	A
Acid, Toxic, or Silt Producing Material Forbidden as Road Surface Material	A	A	A	A	A	A	A	R	A	N	R
Set for Line & Grade Accuracy	N	N	N	N	N	N	N	L	N	N	N
Water Bars are Required for Road Surface by a Prescribed Formula	N	N	N	N	N	N	N	R	A	N	A
Rules Exist Governing Haulroad Abandonment	A	A	L	R	R	N	A	R	A	N	R
Reports											
Monthly	N	N	N	N	N	N	N	N	N	L	N
Quarterly	N	N	N	L	N	L	N	N	N	N	N

TABLE A-1. (Continued)

	MO	NB	NC	OH	OK	PA	SC	TN	VA	WV	Fed
Safety Aspect of Impoundment	A	N	A	A	A	R	A	A	A	R	R
Landowner Consent for Impoundment	A	N	A	A	A	A	A	A	A	R	A
Haulage Roads											
Grading											
a. Maximum sustained grade in percent (shown)	N	N	A	A	N	A	A	R/10%	N	10%	A
b. The maximum pitch of the road defined in percent per feet (indicate)	N	N	A	A	N	A	A	15%/ 300 ft	N	15% 300 ft	A
c. Road crown or inslope of road surface (in inches/foot)											
d. Switch back grade shall be less than the approach grade and always less than indicated 10%	N	N	A	N	A	A	A	10%	R	10%	A
Acid, Toxic, or Silt Producing Material Forbidden as Road Surface Material	A	N	R	A	A	R	S	R	R	R	R
Set for Line & Grade Accuracy	N	N	N	N	N	N	N	N	N	R	N
Water Bars are Required for Road Surface by a Prescribed Formula	N	N	N	N	A	N	A	R	R	R	A
Rules Exist Governing Haulroad Abandonment	N	N	A	A	N	L	N	R	L	L	R
Reports											
Monthly	N	N	N	N	N	N	N	N	N	L	N
Quarterly	N	N	N	L	N	L	N	N	N	N	N

TABLE A-1. (Continued)

	AL	AK	IL	IN	IA	GA	KS	KY	MD	MI	Fed
Annual	N	A	N	A	L	A	L	L	L	L	R
Reclamation	A	A	N	L	N	A	L	L	L	N	R
Revegetation	A	A	L	L	L	A	L	L	L	N	R
Report Must be Accepted or Pass Upon	A	N	L	L	L	A	L	A	A	N	R
Forms are Provided	A	L	A	L	R	A	L	A	N	N	A
Soil Test Report	A	L	L	A	L	A	L	I	L	N	R
Revegetation											
1. Seeding and Planting Required in Appropriate Season	L	L	L	L	R	A	L	L	L	N	R
2. Seed and Plant According to Soil Conditions or Intended Use	L	L	L	L	R	A	L	L	L	N	R
3. Soil Must be Treated to Insure Survival of Plants, if Necessary	L	L	L	L	R	A	L	L	R	N	A
4. Grasses and Legumes - Woody Plant Specified	S	L	L	L	A	A	L	L	A	N	S
5. Plant Survival Required	L	A	L	L	R	A	L	L	L	N	R
6. Alternative Area Revegetation Provision (if approved)	N	L	L	L	N	A	L	L	N	N	N
Additional Requirements											
Testing Water Quality Before Mining or Establishing Before Permit Issued (show on drain plan map)	A	N	A	A	A	A	A	N	R	R	A

TABLE A-1. (Continued)

	MO	NB	NC	OH	OK	PA	SC	TN	VA	WV	Fed
Annual	L	N	A	L	L	L	L	L	R	L	R
Reclamation	L	N	L	L	L	L	L	L	R	L	R
Revegetation	L	N	L	L	A	L	L	L	R	L	R
Report Must be Accepted or Pass Upon	L	N	L	L	A	L	L	L	N	L	R
Forms are Provided	A	N	L	A	A	A	A	R	N	A	A
Soil Test Report	A	N	A	L	A	R	A	R	R	L	R
Revegetation											
1. Seeding and Planting Required in Appropriate Season	L	N	R	L	L	L	A	R	A	R	R
2. Seed and Plant According to Soil Conditions or Intended Use	L	N	R	L	L	R	A	R	R	R	R
3. Soil Must be Treated to Insure Survival of Plants, if Necessary	A	N	R	L	R	A	A	L	R	R	A
4. Grasses and Legumes - Woody Plant Specified	L	N	R	A	A	R	L	R	R	R	S
5. Plant Survival Required	L	N	R	L	A	R	A	L	R	R	R
6. Alternative Area Revegetation Provision (if approved)	L	N	A	N	A	N	A	N	N	N	N
Additional Requirements											
Testing Water Quality Before Mining or Establishing Before Permit Issued (show on drain plan map)	A	N	A	A	A	A	A	N	R	R	A

TABLE A-1. (Continued)

	AL	AK	IL	IN	IA	GA	KS	KY	MD	MI	Fed
Terracing Required for Long Interrupted Final Slopes	R	A	R	1% Varies	R	A	A	L	L	N	N
Seal Off All Breakthroughs and Report by Prescribed Procedures	A	L	A	A	A	A	L	L	R	N	R
Regulates Groundwater As Well As Surface Waters Prohibit Subsurface Drainage	R	N	L	N	L	N	A	N	N	R	R
Discharge Reports	R	R	R	L	A	R	N	R	R	N	R
Fire Road for Access to Area Above Highwall	L	L	A	L	A	A	N	R	R	N	A
Reestablish Survey Monuments	N	N	N	N	N	N	N	N	N	N	A
Department of Transportation Permit or Approval For Using Public Road	A	A	A	A	A	N	N	L	A	A	N
Operation Controls and Restrictions											
Remove and Store Topsoil or Top Layer Must Support Vegetation	S	A	L	A	L	A	L	R	A	N	R
Contour Mining Singled Out for Special Consideration and Control	N	N	N	N	N	N	N	L	N	N	N
Barrier required on contour benches at coal cropping width in feet	N	N	N	N	N	N	N	R	N	N	N
Scalp slope before mining		L		A	N	N	A	L	R	N	A
Fill bench limits (None Haulage Type)	N	N	N	N	N	N	N	N	N	N	A
Mining Prohibited Within a Certain Distance of Features in Sect. III-B-(1-8)	L	L	L	A	N	A	L	100	L	N	R
(A) 1.5 x depth plus 25 feet rule	N	S	S		N	N	N	N	N	N	N
Blasting Laws are a Part of the Act	L	N	N	A	N	N	N	N	N	N	R

TABLE A-1. (Continued)

	MO	NB	NC	OH	OK	PA	SC	TN	VA	WV	Fed
Terracing Required for Long Interrupted Final Slopes	A	N	R	L	A	R	A	R	A	L	N
Seal Off All Breakthroughs and Report by Prescribed Procedures	A	N	A	A	N	L	A	L	A	L	R
Regulates Groundwater As Well As Surface Waters Prohibit Subsurface Drainage	N	N	L	S	N	L	N	R	N	N	R
Discharge Reports	R	N	R	R	A	A	N	L	R	L	A
Fire Road for Access to Area Above Highwall	R	N	N	L	A	A	N	L	R	L	A
Reestablish Survey Monuments	N	N	N	L	N	N	N	N	N	N	A
Department of Transportation Permit or Approval for Using Public Road	A	A	A	A	A	L	N	N	A	A	N
Operational Controls and Restrictions											
Remove and Store Topsoil or Top Layer Must Support Vegetation	N	N	A	L	N	L	A	L	A	R	R
Contour Mining Singled Out for Special Consideration and Control	N	N	N	N	N	L	N	R	A	L	R
Barrier required on contour benches at coal cropping widte in feet	N	N	N	N	N	L	N	R	A	N	R
Scalp slope before mining	L	N	A	A	N	A	N	A	A	R	A
Fill bench limits (None Haulage Type)	A	N	N	N	N	R	N	N	A	L	A
Mining Prohibited Within a Certain Distance of Features in Sect. III-B-(1-8)	L	N	A	50		R	S	100	A	100	R
(A) 1.5 x depth plus 25 feet rule	L	N	N	N	L	N	N	A	A	N	N
Blasting Laws are a Part of the Act	N	N	N	N	N	L	A	A	N	L	R

APPENDIX B. STATE SURFACE MINE RECLAMATION CONTROL LAWS AND RESPONSIBLE AGENCIES

State	Code	Agency
Alabama	The Alabama Surface Mine Reclamation Act	The Alabama Surface Mining Reclamation Commission 1816 8th Avenue, N.W. Birmingham, Alabama 35203 (205) 251-1181 832-6011
Arkansas	Arkansas Open Cut Land Reclamation Act 236 of 1971	Arkansas Pollution Control Commission 1100 Harrington Little Rock, Arkansas 72202 (501) 371-1701
Georgia	Georgia Surface Mining Act of 1968 Act No. 620 as amended through 1972 Rule and Regulation Chapter 39132	Department of Natural Resources Environmental Protection Division 270 Washington St., S.W. Atlanta, Georgia 30334 (912) 744-3346
Illinois	Surface Mined Land Conservation & Reclamation Act of 1971 PA 78-1295 Effective 7-1-75	Land Reclamation Division of the Department of Mines and Minerals State Office Building Springfield, Illinois 62706 (217) 782-4970
Indiana	An Act Regulating Surface Mining of Coal Clay and Shale Chapter 344, Act of 1967 as amended by Act of 1974	Division of Reclamation Department of Natural Resources 613 State Office Building 100 North Senate Avenue Indianapolis, Indiana 46202 (317) 633-6217
Iowa	An Act Relating to Surface Mining Chapter 83A	Department of Soil Conservation Division of Mines and Minerals Grimes Building Des Moines, Iowa 50319 (515) 281-5774
Kansas	Mineral Land Conservation and Reclamation Act Article 4	Mined Land Conservation and Reclamation Board of Kansas (913) 295-0111

State	Code	Agency
Kentucky	Chapter 350 Kentucky Revised Statutes	Division of Reclamation Department of Natural Resources Frankfort, Kentucky 40601 (502) 564-3350
Maryland	Maryland Strip Mining Law Title and Subtitles	Department of Natural Resources Tawes State Office Building Annapolis, Maryland 21901 (301) 267-1230
Michigan	Mine Reclamation Act of 1970, as amended Act No. 92 of the Public Acts of 1970 as amended	Department of Natural Resources Steven T. Mason Building Lansing, Michigan 48921 (517) 373-2329
Missouri	I Reclamation of Mining Land II The Land Reclamation Act	Department of Natural Resources Box 176, Jefferson City Missouri 65101 (314) 751-3332
Nebraska	Legislative Bill No. 681	
North Carolina	Mining Act of 1971	Department of Natural & Economic Resources Administrative Building Raleigh, North Carolina 27611 (919) 733-4984
Ohio	Strip Mining & Reclamation of Mined Land	Department of Mines 2323 W. Fifth Avenue Columbus, Ohio 43204 (614) 466-4240
Oklahoma	Mined Lands Reclamation Act	Department of Mines State Capital Building Oklahoma City, Oklahoma 73105 (405) 521-3859
Pennsylvania	Surface Mining Conservation & Reclamation Act	Department of Environmental Resources Evangelical Press Building Harrisburg, Pennsylvania 17105

State	Code	Agency
South Carolina	South Carolina Mining Act	Land Resources Conservation Commission P.O. Box 11708 Columbia, South Carolina 29211 (803) 758-2823
Tennessee	Tennessee Surface Mining Act Chapter is 58-1501→58-1564	Department of Conservation 2611 W. End Avenue Nashville, Tennessee 37203 (615) 741-3011
Virginia	Coal Surface Mining Act of 1971 Title 45.1 Chapter 16 Code of Virginia	Department of Conservation and Economic Development 1100 State Office Building Richmond, Virginia 23219 (804) 786-2121
West Virginia	Article 6 Chapter 20 Code of West Virginia as amended	Department of Natural Resources Division of Reclamation State Office Building #3 Charleston, West Virginia 25305 (304) 348-3267

APPENDIX C. EPA MANUALS RELATED TO ENVIRONMENTAL CONTROL FOR SURFACE COAL MINING

Barnhisel, R., 1977, Reclamation of Surface Mined Coal Spoils, EPA-600/7-77-093, U.S. Environmental Protection Agency, Washington, D.C.

Carrucio, F., 1977, Paleoenvironment of Coal and Its Relation to Drainage Quality, EPA-600/7-77-067, U.S. Environmental Protection Agency, Washington, D.C.

Hittman Associates, 1976, Erosion and Sediment Control: Surface Mining in the Eastern U.S. - Volume 1: Planning, EPA-625/3-76-006a, U.S. Environmental Protection Agency, Washington, D.C.

Hittman Associates, 1976, Erosion and Sediment Control: Surface Mining in the Eastern U.S. - Volume 2: Design, EPA 625/3-76-006b, U.S. Environmental Protection Agency, Washington, D.C.

Lovell, H., 1973, Appraisal of Neutralization Processes to Treat Coal Mine Drainage, EPA-670/2-73-093, NTIS: PB 231 249/AS, U.S. Environmental Protection Agency, Washington, D.C.

Ohio State University, 1976, Resource Allocation to Optimize Mining Pollution Control, EPA-600/2-76-112, U.S. Environmental Protection Agency, Washington, D.C.

Randall, A., 1978, Estimating Environmental Damages from Surface Mining of Coal in Appalachia: A Case Study, EPA-600/2-78-003, U.S. Environmental Protection Agency, Washington, D.C.

Smith, R., 1976, Extensive Overburden Potentials for Soil and Water Quality, EPA-600/2-76-184, NTIS: PB 257 739/AS, U.S. Environmental Protection Agency, Washington, D.C.

Sobeck, A., 1978, Field and Laboratory Methods Applicable to Overburdens and Minesoils. EPA-600/2-78-054, U.S. Environmental Protection Agency, Washington, D.C.

Wilmoth, R., 1978, Combination Limestone-Lime Neutralization of Ferrous Iron Acid Mine Drainage, EPA-600/2-78-002, U.S. Environmental Protection Agency, Washington, D.C.

Wilmoth, R., 1977, Limestone and Lime Neutralization of Ferrous Iron Acid Mine Drainage, EPA 600/2-77-101, U.S. Environmental Protection Agency, Washington, D.C.

APPENDIX D. MAJOR FUNCTIONS OF THE OFFICE OF SURFACE MINING REGULATION AND ENFORCEMENT

1. Administers the programs for controlling surface coal mining operations required by the Act.* Reviews and approves or disapproves State programs for controlling surface coal mining operations and reclaiming abandoned mined lands. Makes those investigations and inspections necessary to insure compliance with the Act. Conducts hearings, administers oaths, issues subpoenas, and compels the attendance of witnesses and production of written or printed material as provided for in the Act. Issues cease-and-desist orders. Reviews and vacates or modifies or approves orders and decisions. Orders the suspension, revocation, or withholding of any permit for failure to comply with any of the provisions of the Act or any rules and regulations adopted pursuant thereto.

2. Publishes and promulgates such rules and regulations as may be necessary to carry out the purposes and provisions of the Act.

3. Administers the State grant-in-aid program for the development of State programs for surface mining and reclamation operations provided for in Title V of the Act.

4. Administers the program for the purchase and reclamation of abandoned and unreclaimed mined areas pursuant to Title IV of the Act.

5. Administers the surface mining and reclamation research and demonstration project authority provided for in the Act.

6. Consults with other agencies of the Federal government having expertise in the control and reclamation of surface mining operations and assists States, local governments, and other eligible agencies in the coordination of such programs.

7. Maintains a continuing study of surface mining and reclamation operations in the United States.

8. Develops and maintains an information and data center on surface coal mining, reclamation, and surface impacts of underground mining to make data available to the public, to the Federal, regional, State, and local agencies conducting or concerned with land use planning, and to agencies concerned with surface and underground mining and reclamation operations.

9. Assists the States in the development of State programs for surface coal mining and reclamation operations that meet the requirements of the Act and at the same time reflect local requirements and local environmental and agricultural conditions.

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* The Act referred to in this table is the Surface Mining Control and Reclamation Act of 1977 (Public Law 95-87).

10. Assists the States in developing objective scientific criteria and appropriate procedures and institutions for determining those areas of a State to be designated unsuitable for all or certain types of surface coal mining pursuant to section 522.

11. Monitors all Federal and State research programs dealing with coal extraction and use and recommends to Congress the research and demonstration projects and necessary changes in public policy that are designated to (A) improve feasibility of underground coal mining, and (B) improve surface mining and reclamation techniques directed at eliminating adverse environmental and social impacts.

12. Cooperates with other Federal agencies and State regulatory authorities to minimize duplication of inspections, enforcement, and administration of the Act.

13. Performs such other duties as may be provided by law and relate to the purposes of the Act.

APPENDIX E. TYPICAL DATA REQUIRED FROM COMPANIES APPLYING FOR A MINING PERMIT

PART I. IDENTIFICATION OF APPLICANT AND MINE SITE

A. Nature of Operation

1. Is this a new or an amended permit application?
2. Have any violations occurred on this permit?
3. If this is an amended permit, will the area increase or decrease?
4. If this is an amended permit, will the time increase or decrease?
5. What is the name or pit number?
6. Is a prospecting permit being converted to a mining permit?
7. Prospecting permit number and acreage.

B. Applicant's Identity

1. Applicant name, local address, and local phone number.
2. Applicant permanent address and phone number.
3. Give brief directions for locating the local office.
4. Office to which registered mail is delivered (registered agent's address).
5. List name and title of persons representing the company.
6. List names and address of the mine manager and superintendent.
7. List names and addresses of persons having more than 10% interest in the firm.
8. Type of organizations.
   a. Proprietorship
   b. Partnership
   c. Corporation - What is the home State of this corporation?
   d. Joint venture
9. List names and addresses of other persons having control over the company.

C. Qualifications of Applicant

1. Give the firm's strip mine license number.
2. List all previous and existing permits held by the company (state & number).
3. Have any of the persons of authority ever had a permit removed or suspended?
4. Has a land entry agreement been submitted with the application?
5. Has the public notice been posted according to the prescribed method?

D. Ownership Data

1. List names and addresses of the owners of minerals to be mined.
2. List names and addresses of the owners of the suface land to be disturbed.

3. List names and addresses of the reputed owners of all land within 1000 feet of the permit boundary.
4. Have these people been notified by mail?
5. Produce the legal source to enter in and operate on the area in this permit.

E. Site Information

1. Area already mined.
2. Size of the area.
3. Breakdown of the area to be disturbed.
   a. Mining area
   b. Access and haulroad area
   c. Drainage system area
   d. Physical plant area
   e. Stock pile area
   f. Water impoundment area
   g. Total area
4. Estimated duration of activities.
   a. Commence construction date
   b. Commence operating date
   c. Complete backfilling and grading
   d. Complete revegetation data
   e. Total months
5. Mine location.
   a. County
   b. Township range and section
   c. Nearest town or village (direction and distance)
   d. Nearest highway
   e. Latitude and longitude
6. How many acres were mined last year?
7. How many acres were reclaimed last year?

PART II. IDENTIFICATION OF PERMITS, FEES, BONDS, ETC.

A. Fee, Taxes, Bonds, and Insurance

1. Permit fee.
2. Amendment fee.
3. Reclamation tax.
4. Bond amount.
   a. Cash
   b. Negotiable instruments
   c. Surety (give names and addresses)
5. Sworn statement guaranteeing the truth of information given.
6. Date.
7. Signature.
8. Title.
9. Notarization.

3. List names and addresses of the reputed owners of all land within 1000 feet of the permit boundary.
4. Have these people been notified by mail?
5. Produce the legal source to enter in and operate on the area in this permit.

E. Site Information

1. Area already mined.
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   d. Complete revegetation data
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   a. County
   b. Township range and section
   c. Nearest town or village (direction and distance)
   d. Nearest highway
   e. Latitude and longitude
6. How many acres were mined last year?
7. How many acres were reclaimed last year?

PART II. IDENTIFICATION OF PERMITS, FEES, BONDS, ETC.

A. Fee, Taxes, Bonds, and Insurance

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2. Amendment fee.
3. Reclamation tax.
4. Bond amount.
   a. Cash
   b. Negotiable instruments
   c. Surety (give names and addresses)
5. Sworn statement guaranteeing the truth of information given.
6. Date.
7. Signature.
8. Title.
9. Notarization.

10. Insurance.
    a. Amount
    b. Company name
    c. Address
    d. Surrender the policy

B. Other Permits That May be Required

1. Federal permits.
    a. Water and pollution discharge permit (NPDES)
    b. Approval of ground control plan (MA)
    c. Permit for work involving navigable waters (COE)
    d. Permit to construct RR bridge over navigable waters (USCG)
    e. Railroad service extension permit (ICC)
    f. Permit to operate microwave equipment (FCC)
2. State permits.
    a. Refuse disposal permits
    b. Road relocation permit
    c. Highway use permit
    d. Stream encroachment permit
    e. Industrial siting permit
    f. Water pollution permit
3. Local permits.
    a. County road permit
    b. Zoning permit
    c. Sanitary and health permit for sewage disposal
    d. Garbage disposal permit

PART III. SUPPORTING SITE ANALYSIS DATA

A. General Map Requirements

1. Certification by a licensed engineer or surveyor.
2. Use a consistent color code.
3. USGS map 1 inch = 500 ft.
4. North arrow.
5. Area of present and possible future permits adjacent to present permits.
6. Boundary location, total area, and operation.

B. Land Use Analysis

Locate the following land use types within 1000 ft of permit boundary.

1. Railroads.
2. Roads.
3. Utilities (water lines, pipe lines, or power lines).
4. Buildings.
5. Cemeteries.
6. Oil and gas wells.

7. Underground surface and auger mines.
   a. Location and thickness of all barriers to adjacent deep mines
   b. Are these mines active or abandoned?
8. Historic monuments.
9. State parks.
10. State game preserves.
11. Archaeological and paleontological sites.
12. Favored hunting and fishing areas.
13. Other special significant sites.

C. Topographic Analysis

1. Vertical relief contour map.
2. Vertical section of mine every 200 ft.
3. Accuracy tolerances.

D. Soils Analysis

1. Map of soil.
2. Agricultural characteristics.
   a. Soil types
   b. Depth of soil
   c. Depth of the A, B, and C horizons
   d. Slope of soil
3. Engineering Characteristics.
   a. Pertinent soil bearing strengths
   b. Other physical characteristics

E. Geologic Analysis

1. Location of drill holes with appropriate number.
   a. Type of drill hole
   b. Lithologic log of the hole
   c. Drillers' logs showing location of water table
2. Overburden characterization.
   a. Stratigraphic column
   b. Dips and strike of beds
   c. Presence of acid-forming material
      (1) Amount of iron disulfide
      (2) Iron disulfide grain size
      (3) Iron disulfide location by stratigraphic unit
      (4) Give acid-forming material bed location
   d. Presence of alkalinity potential
      (1) Limestone
      (2) Calcareous shale
         (a) tin beds
         (b) nodular

(3) Calcareous glacial drift
(a) till
(b) windblown
(c) sand and gravel
(4) Calcareous drift position and thickness

3. Coal bed characterization.
   a. Dip and strike of bed(s)
   b. Coal seam outcrop line
   c. Coal seam name
4. Locate the following features (within 1 mile of site).
   a. Springs (indicate those which are in use)
   b. Wells (drilled or dug)
   c. Show location of water table (piezometric surface)

F. Analysis of Water Resources

1. Hydrologic features (within 1000 ft of permit boundary) - provide a drainage plan map (scale 1 inch = 500 ft)
   (1) Show total watershed area
   (2) Show disturbed watershed area
   (3) Show major drainage system with flow direction arrows
   (4) Show interim tributaries
   (5) Show all water bodies
   (6) Locate all drainage structures
      (a) ditches
      (b) diversion structures
      (c) collection structures
      (d) dispersion structures
      (e) water impoundments (sedimentation ponds)
   (7) Locate all treatment facilities
   (8) Name and locate all receiving streams and waterways
   (9) Locate all pump stations
   (10) Locate water test sites and sampling points
   (11) Locate all discharge points on receiving stream
2. Existing water quality.
   a. Streams and rivers
   b. Ponds and lakes
   c. Groundwater
3. Provide an analysis of each stream. Samples must be taken downstream of proposed mine site.
   a. Was analysis done by a standard method and a qualified chemist?
   b. Analyze for: pH, hot acidity, mineral, alkalinity, total iron, total aluminum
   c. Total manganese, sulfate, TSS, TDA
   d. List on the analysis sheet the following:
      (1) Name of applicant
      (2) Name of individual collecting sample
      (3) Date of sample and date of analysis
      (4) Sample location

(5) Name, address and phone number
(6) Signature of chemist responsible
(7) Units of measure used in report

4. Does mine drainage currently exist at the mine site?
   a. Do these mines have drainage collection points?
   b. Submit an analysis of the water from those collection points

PART IV. MINING OPERATION PLAN

A. Proposal Map

1. Show the direction of mining and the sequence and number of cuts.
2. Note location and extent of auger mining.
3. Locate haulroads on a map of scale.
4. Locate and note size of all culverts and bridges on haulroads.

B. Site Preparation

1. Will mine be dewatered? Why?
2. Measures for site preparation and abandonment.
3. Describe the clearing and grubbing procedures and vegetation disposal methods.
4. Describe method of removing and storing the topsoil.
5. Describe premining construction (what, where, when).
6. Describe other premining activities.

C. Mining Type Practiced

1. Contour.
2. Mountaintop removal.
3. Will barriers be left at this mine?
4. Area.
5. Auger.
   a. Show pattern of auger holes
   b. What will be the depth of the holes?
   c. How will auger holes be prevented from intersecting U/G mine pools?
   d. Will auger holes be filled in after mining?

D. Pit Description

1. Pit width maximum, minimum, average.
2. Bench width maximum, minimum, average.
3. Highwall height maximum, minimum, average.
4. Length of cut maximum, minimum, average.
5. Ultimate highwall height.
6. Will drainage structures intercept water above the highwall?

E. Neighboring Mines

1. Adjacent operations active and abandoned (deep, surface, or auger).
2. Is the adjacent mine regraded and revegated and to what extent?

3. Will the mine daylight any U/G mines?
4. Estimate the barrier width that exists between this mine + U/G mines.
5. Submit a plan and cross section showing how these will be sealed.

F. Blasting

1. How many blasts will be required by the operations?
2. Detail the blasting procedures.
3. How will neighbors be notified before blasts?
4. When will neighbors be notified before a blast?
5. During what hours will blasting be scheduled?
6. How will damage from air blasts and vibration be prevented?
7. List other blasting safety precautions.

G. Haulroads

1. Give a haulroad profile; indicate grades, curves, culverts, water bars.
2. Show portions of road constructed on fill.
3. Give the road grades maximum, minimum, average.
4. Give maximum pitch of the road in % per feet.
5. Give the crown or inslope of the road surface.
6. Give the grade on switch backs.
7. Describe the road surfacing and subgrade material.
8. Will special surfacing material be used?
9. Give the tolerances to which the road will be built.
10. Will drainage structures be provided along haulroads and through road cuts?
11. Will water be intercepted at switchbacks on haulroads?
12. Give details of how haulroads will cross streams.

H. Other

1. How close will the excavation come to civil features?
2. Will written permission from the owner be needed for closer excavation?
3. How close will mining come to a natural drainage way?
4. Will any overburden be placed in a natural drainway?
5. How will overburden be prevented from entering the natural drainway?

I. Mine Water Requirements

1. Quantity required and purpose.
   a. Washing plants and initial and make up
   b. Sanitary water
   c. Dust control
      (1) Plant dust
      (2) Road dust

2. Storage facilities.
   a. Number
   b. Location
   c. Size
3. Source of Water.
   a. Groundwater
   b. Surface water
   c. Public water

PART V. ENVIRONMENTAL CONTROL PROVISIONS

A. Spoil

1. Spoil characterization.
   a. Estimate the character of the resulting spoil
   b. Spoil rock mix
   c. Will spoil contain refuse?
2. Locate acid-forming material and explain where and how toxic, flammable, and acid-producing materials will be placed.
3. How deep and how well will the exposed coal face be covered?
4. Locate alkalinity or neutralization potential.

B. Erosion and Sediment Control

1. Acres susceptable to erosion.
2. Describe erosion control and sediment control measures.
3. Acres of watershed above mine.
4. Acres of watershed above discharge point.
5. Estimate amount of surface runoff.
6. Give minimum stream flow of immediate receiving stream.
7. Maximum and minimum 7-consecutive-day flow occurring once in 10 years.
8. Maximum and minimum stream flow.
9. List flood protection measures.

C. Flood Control

1. Discuss flood control measures.
2. Estimate the uncontrolled water velocity for each structure (ditch and water impoundments)
3. Estimate the control water velocity for each structure.
4. Give character of soil + rock under water impoundments.
5. Will drainage structures be constructed on the solid part of the benches?
6. How will water accumulations be discharged from the pit?
   a. Will drainage structures be provided below the spoil?
   b. Will drainage structures discharge over the spoil?
7. How long will the drainage structures be required?

8. Give specifications of all drainage structures.
   a. Give the design capacity of each drainage structure
   b. Include: maximum, minimum, and average capacity
   c. Give the dimensions of each drainage structure
9. Will any drainage structure be left at the end of the job?
   a. Has the owner given written permission for this?
   b. Has the owner agreed to maintain this structure?
   c. Will these structures modify the backfilling and grading requirements?
10. Provide a proposal of pollution incident prevention methods.
11. Explain the design criteria used to answer these questions.

D. Groundwater Treatment

1. Describe the groundwater existing in the area and how it will be affected by the mine.
   a. Mine above water table
   b. Mine below water table
   c. Mine both above and below the water table
   d. Is mine in a groundwater recharge zone?
   e. Is mine in a groundwater discharge zone?
   f. Groundwater coming from the highwall
   g. Groundwater coming from the spoil
   h. Will groundwater affect mining method and how?
2. Aquifers.
   a. Above seam to mined (characteristics)
   b. Gravel and sand
   c. Porous stone
   d. Fractures and joints
   e. Other
3. Well information.
   a. Well depth
   b. Owner
   c. Casing length
   d. Yield
   e. Static head or water level
   f. Date
   g. Well time
   h. Chemical and biological analysis
4. Will the mine dewater any wells?
   a. Estimate drawdown caused by mine on well(s)
   b. Estimate drawdown radius
   c. Is the aquifer being used within one mile?
   d. Could this aquifer be used?
   e. Impact of mine on adjacent water resources
   f. Will this mine be affected by other mines? Why?
   g. Will this mine affect other mines? Why?
5. How was the estimate determined?

E. Mine Drainage

1. Impact of mining on water quality.
   a. What will the quantity and quality of the water be? Why?
   b. Post mining water quality
2. Waste treatment.
   a. Is it treated?
   b. Will treatment be used?
   c. Describe the treatment facilities and sequence of the treatments
   d. Submit plans and drawings of these treatment facilities
   e. Give schematic flow diagram of water treatment facilities
3. Operation features.
   a. Type of waste
   b. Will analytical method used be standard method during monitoring?
   c. Analyze for
      (1) pH
      (2) Alkalinity
      (3) Suspended solids (Mg/l)
      (4) Suspended solids (Mg/l and lb/day)
      (5) Settable solids (Mg/l)
      (6) Dissolved solids (Mg/l)
      (7) Iron, dissolved and total
      (8) Manganese
      (9) Aluminum
      (10) Sulfate
      (11) Turbidity
4. Treatment.
   a. Amount treated
   b. Not treated
   c. Combined
5. Waste load or estimated before and after treatment.
6. Standby equipment parts inventory or availability.
7. What measures will be taken to control hazards.
   a. Will any mine water be discharged during flood or facility breakdown?
   b. Will alternate storage of water be made use of?
8. Source of waste and location.
   a. Total waste flow average and maximum
   b. Will the treated water be above a satisfactory minimum standard?
   c. Give latitude and longitude of discharge point

F. Pumping Facilities

1. Number of pumps.
2. Classifications.
   a. Raw waste
   b. Recirculation
   c. Raw sludge

d. Effluent pump
e. Mine drainage pump

3. Indicate points of suction and maximum suction head.
4. Specify point of discharge and discharge head.
5. Pump capacity.
6. Are these pumps
   a. Variable speed
   b. Automatically controlled
   c. Manually controlled
   d. Well or sump
7. Total capacity.
8. Effective capacity.

G. Type of Processes (Bath, Continuous, Neutralization, Oxidation, PPT., Reduction, Other Types of Processes)

1. What instrumentation and alarms will be used?
2. Waste load and characteristics.
3. Quantity of water to be handled.
   a. Forward flow
   b. Recirculation flow
   c. Combined
   d. Hydraulic loading during runoff period
4. Flow equalization and storage basins.
   a. Will basin be excavated or dike type?
   b. Storage of treated and untreated waste
   c. Material and characteristics of basins
   d. Construction materials
   e. Are construction materials resistant to the waste or chemicals used?
   f. Earthen inside slope outside slope, berm width
   g. How will slides be protected from wave action
   h. Wood
   i. Steel
   j. Average dimensions
   k. Length, width, or diameter
   l. Depth, normal, maximum, freeboard
5. Design data (capacity, normal, maximun).
6. Describe outlet and water level control.
   a. Waste enters by gravity or pump
   b. Is inlet designed to give adequate flow distribution? Will pond be restored?
   c. Waste leaves by gravity or pump
   d. Are weirs adjustable?
   e. Retention time
7. Aeration system.
   a. Aeration tanks or basins
   b. Capacity
   c. Waste water source
   d. Type of construction
      (1) Bill of construction materials
      (2) Bill of equipment used

e. Aeration or contract
f. Stabilization or reaeration
g. Oxidation ditch
(1) Design information
(2) Maximum liquid depth
(3) Cross-sectional velocity
(4) Provisions for varying liquid level
(5) Dimensions: Length, width, diameter, swd, freeboard, detention time
h. Diffused aeration

8. Chemical treatment.
a. Chemical or trade names, dosage, application point
b. Location of chemical storage area: will an adequate supply be provided?
c. Is chemical storage protected?
d. Describe the control points
e. Feeder type: Manual, auto, standby
f. Capacity: lb/day, range
g. Time required for process
h. Mixing devices: number/unit, type of mixer, rapid mixing, slow mixing
i. Effluent characteristic of treatment units

9. Sludge production.
a. Show unit producing sludge
b. Type of unit: Tank or earthen
c. Design of unit: length, width, diameter, swd, freeboard, detention time
d. How will sediment accumulations be handled?
e. Describe method and frequency of sludge removal
f. If sludge is to remain in pond, how long will operation sustain?

10. Waste disposal.
a. Washing plant waste. How and where?
b. Sanitary waste (sewage, etc.). How and Where?
c. Solid waste (trash, litter, oil and grease). How and where?

11. Settling tanks and earthen settling basins
a. How will solids be removed from this unit?
b. Will process increase solids loading? How and when?

PART VI. RECLAMATION AND REVEGETATION

A. Backfilling and Grading

1. On a contour map as it is planned to be backfilled and graded show:
a. Water impoundment to remain
b. Drainage ditches
c. Haulroad
(1) Access to area above highwall
(2) For other purposes

d. The reduced highwall
e. Area to receive topsoil

2. Description of backfilling and grading.
   a. How will graded area be protected from erosion before vegetation is established?
   b. Describe regrading method, include direction of grading
   c. How will highwall be reduced?

B. Revegetation

1. Vegetation types.
   a. Trees
      (1) Areas to receive seedlings (locate on regraded contour map)
      (2) number per acre
      (3) list tree species
   b. Woody stem bushes
      (1) Area to receive woody stem plants (locate on regraded contour map)
      (2) number per acre
      (3) list varieties
   c. Grasses, legumes and flowers
      (1) Area to receive grasses, legumes, and flowers
      (2) Application rate: pound per acre
      (3) List varieties
2. Describe planting methods.
   a. Trees
   b. Woody stems
   c. Grasses, legumes, and flowers
   d. If hydroseeding and mulching will be used, describe mulch
3. Seed innoculation and fertilizer
   a. Will a soil analysis plan be used to determine fertilizer?
   b. Fertilizer
      (1) Type: name
      (2) Application rate in lb/acre
      (3) Will the fertilizer be quick or slow release?
   c. Seed innoculation
      (1) What will the seed be innoculated with?
      (2) Application rate